S.W.G. Ellyard
B.Sc. (London), B.Ed.

illustrated by Aubrey Collette

edited by
Owen Martin

FUN WITH NATURAL SCIENCE

GRADE FOUR

RECOMMENDED by the

N.S.W. Primary Textbook Reviewing Committee

a **HORWITZ-MARTIN** text book

By the same author:

Fun With Natural Science, Books 2-6
A First Science Book for Secondary Students

Published by
HORWITZ-MARTIN PTY LTD
2 Denison Street,
North Sydney, N.S.W. 2060

First published 1965

Registered in Australia for transmission by post as a book
National Library of Australia Registry No. AUS 69-2690

Printed in Hong Kong by Peninsula Press Ltd.

PN175

TO THE TEACHER.

This book, as was the previous book in this series, is essentially a work book for the individual child.

The material, experimental work and language should be within the ability and interest of the Fourth Class child and properly completed it will provide an adequate record of work done, problems solved and conclusions reached.

There may be more material than can be comfortably handled in the classroom but the arrangement of the work will make it possible for much of the work to be done individually and as home exercises. In fact some of the work will have to be done at home.

There is a small amount of repetition of work included in the previous book. This was essential so that satisfactory starting places could be obtained. It will provide useful revision for those who have worked through the previous book.

While a certain amount of information is provided the teacher will need to supplement his own knowledge by reference to the various sources suggested in the Natural Science Syllabus.

Experience has shown that this book does arouse interest in Natural Science and children then seek further information in more detailed books found in the library.

Emphasis should at all times be placed on accuracy in observation and recording as such is fundamental to the development of a scientific attitude.

Owen Martin,

Editor.

TO THE CHILDREN.

This is your book and I hope you will have much fun in working through it.

Those of you who have worked through the previous book in this series will find that you have done a little of this work before. I had to include some work that was in the first book so that I could find a proper starting place. In any case it will remind you of what you have done before.

A good scientist is always careful and I am sure you all want to be good scientists. So, always:

LOOK CAREFULLY

THINK CAREFULLY

RECORD CAREFULLY.

When you are colouring in always be sure you have the right colours. Your book will look just as beautiful and it will be accurate and that is most important.

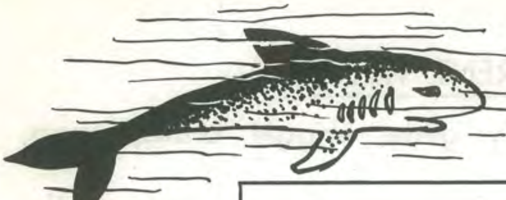
You may not always be able to find the right answers to the questions. Sometimes there is not just One right answer.

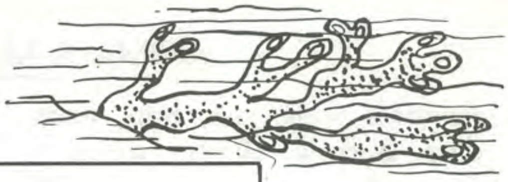
Write down what you have thought out from what you know. That is what any scientist does. When he knows more he may find he was wrong at first and you may find that too.

Always work neatly and tidily because that is necessary for a good scientist too.

I wish you many happy hours.

S. W. G. Ellyard.





PLANTS OR ANIMALS







All living things are PLANTS or ANIMALS.

PLANTS stay and grow in the one place.

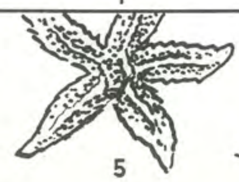
They are not able to move to another place.

ANIMALS can move themselves from one place to another. They can move and stop when they wish.

Decide which of the pictures are of PLANTS or ANIMALS. Write the names in the proper column. If you have room add some more.

PLANTS	ANIMALS





ANIMALS MOVE IN DIFFERENT WAYS

Animals walk, run, hop, jump, spring, swim, fly, glide, wriggle, crawl, creep, dive, burrow, climb, swoop.
Some do more than one of these. Write opposite each of these animals the word or words which describe how it moves. If none of the above words fit, try to find one of your own.

cat	swallow ....
rabbit	emu ....
frog	shark ....
seagull	worm ....
bat	snake ....
flying fox	snail ....
caterpillar	echidna ....
lizard	jellyfish ....
hunting spider	ant ....
goldfish	octopus ....

ANIMALS MOVE IN DIFFERENT PLACES

Animals move on Land, in the Water and in the Air. Some move in two or even three of these. List below where the animals move.

	Land	Water	Air	
Magpie	....	....	....	Goldfish
Frog	....	....	....	Man
Swift	....	....	....	Crab
Butterfly	....	....	....	Elephant
Whale	....	....	....	Shark
Duck	....	....	....	Tadpole
Flying Fish	....	....	....	Water Beetl
Porpoise	....	....	....	"Wriggler"
Platypus	....	....	....	Eel
Emu	....	....	....	Turtle

ANIMALS WHICH DO NOT MOVE

Though all animals can move at some time in their lives, a few move about only when they are young. As they grow older they settle in one place and stay there. Most of them live in water. Here are four that do this.

Oyster

Sea Anemone

Barnacle

Sea Squirt

If they cannot move how do they get their food? ....

....

ANIMALS PROTECT THEMSELVES AND THEIR BABIES

All animals have enemies so they must protect themselves.

Many animals have special weapons.

These include sharp teeth, claws, tusks, horns, hoofs, nippers, stings.

Some animals can move very quickly.

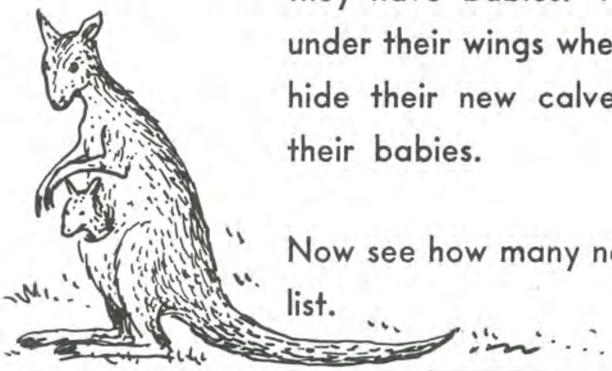
Others have good hearing, sight or smell.

Some animals have shells or spines.

Others can climb well or dig into the ground.

Some animals are so coloured or shaped that they are difficult to see. This is called CAMOUFLAGE. Stick and leaf insects do this. Some creatures have a warning colour, usually red or yellow.

Mother animals usually take great care of their babies. Timid animals will become fierce when they have babies. Hens hide their chickens under their wings when there is danger. Cows hide their new calves. Many animals carry their babies.



Now see how many names you can fill in each list.

Teeth, Tusks, Horns, Claws, Stings, Nippers	Shells or Spines	Quick Movers

Climbers or Diggers	Camouflage	Good Sight, Smell or Hearing

WATER OUT OF THE AIR

Experiment. Put some ice-cubes in a screw-top jar and fill up with water. Screw the top on tightly. Dry the outside of the jar carefully. Let the jar stand for awhile. Watch what happens.

What do you see on the outside of the jar? ....

Where did it come from? ....

....

If you think it may have come out of the jar dry the jar and watch again.

Draw what you see

There is always water in the air. Water in the air is called water-vapour. Water is a liquid. Water vapour is a gas. We cannot see water-vapour.

Warm air can hold more water-vapour than .... air.

When air is cooled, some water-vapour changes to .... This is called CONDENSATION.

When warm air touches a cold surface drops of .... are formed.

DEW, FROST, MIST AND FOG

At night the air near the ground becomes cooler. The water vapour condenses to form .... We find dew on ....

....

....

If the air becomes very cold the water-vapour changes to ice crystals. This is ....

Draw drops of dew on this flower

Where can you find frost in your house all the time? ....

Look at some through a magnifying glass.

If a large amount of warm air is cooled, tiny drops of water form in the air. This is .... A thick mist is a .... Smoke or dust helps water-vapour condense so fog is more common in cities.

Experiment. 1. Fill a jar with hot water. 2. Leave it for a few minutes. 3. Pour out most of the water. 4. Light a rolled-up piece of paper, and let it burn in the jar for a few seconds. 5. Cover the jar with a tin lid with ice cubes on it.

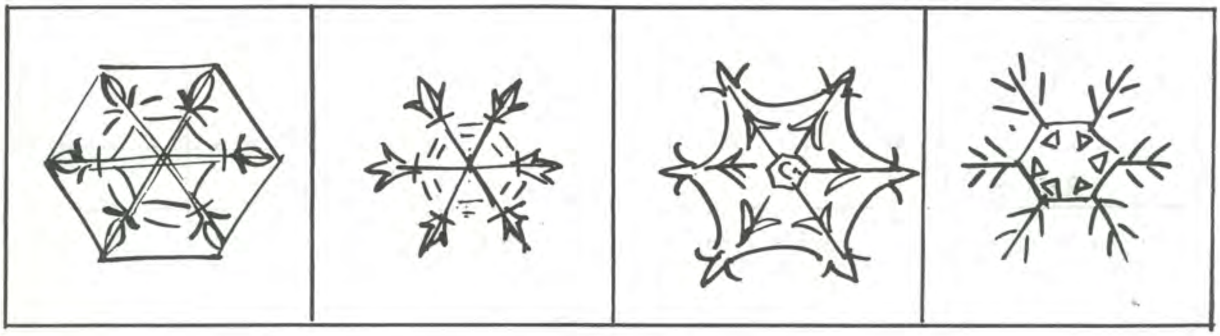
You have made a fog

Draw what you see

CLOUDS, RAIN, SNOW, HAIL

Clouds are fog high in the air. The air high up is colder so the water-vapour condenses more readily. The tiny drops of water join together until they are too heavy to stay up. Then they fall as ....

If the air is very cold the water-vapour changes to crystals of ice. The crystals grow bigger until they are too heavy to stay up. Then they fall as .... If snow falls where you live catch some on a black cloth. Look at it under a magnifying glass. Snow crystals are very beautiful. They nearly always have six sides.



SNOW CRYSTALS

Sometimes falling rain may be carried high in the sky by an upwind. It becomes so cold it turns to ice. This falls as .... If hail falls where you live cut a hailstone in two.

What can you see?...

What is in the middle?...

WATER INTO THE AIR

What happens to the water:

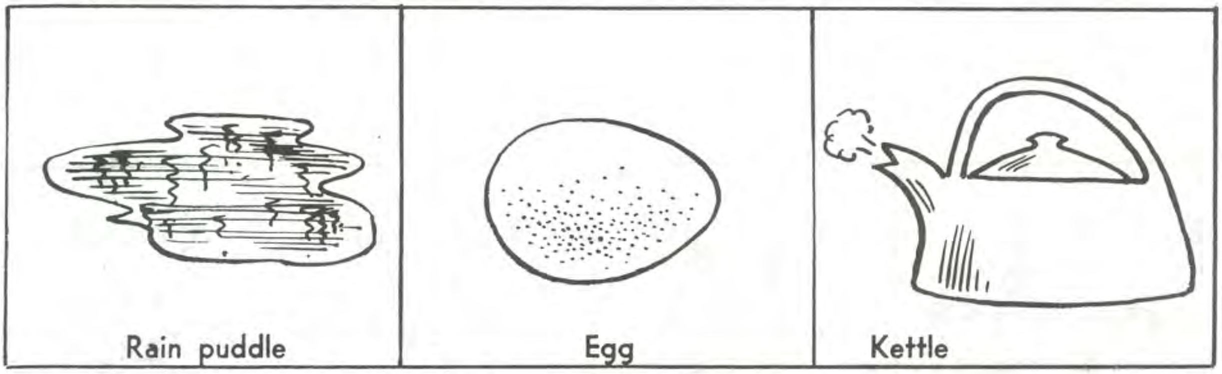
(a) In rain, puddles when they dry up? ....

....

(b) On a boiled egg when you take it out of the boiling water? ....

....

(c) In a kettle when it boils dry? ....



Show by arrows the water going into the air.

When water goes into the air it EVAPORATES.

The water changes to ....

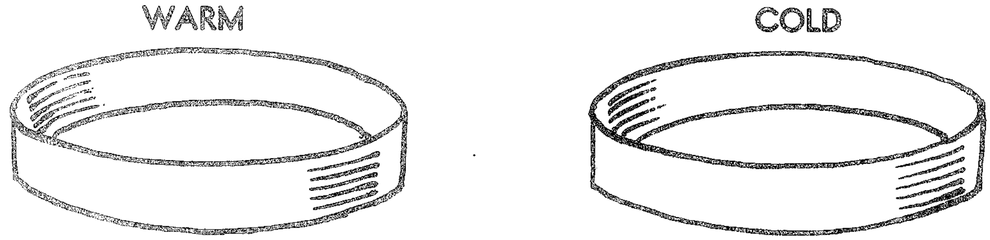
Experiment. Fill two equal sized tin lids with water.

Place one in the refrigerator or some other cool place. Place the other in the sun or on a radiator.

Which water evaporates first? ....

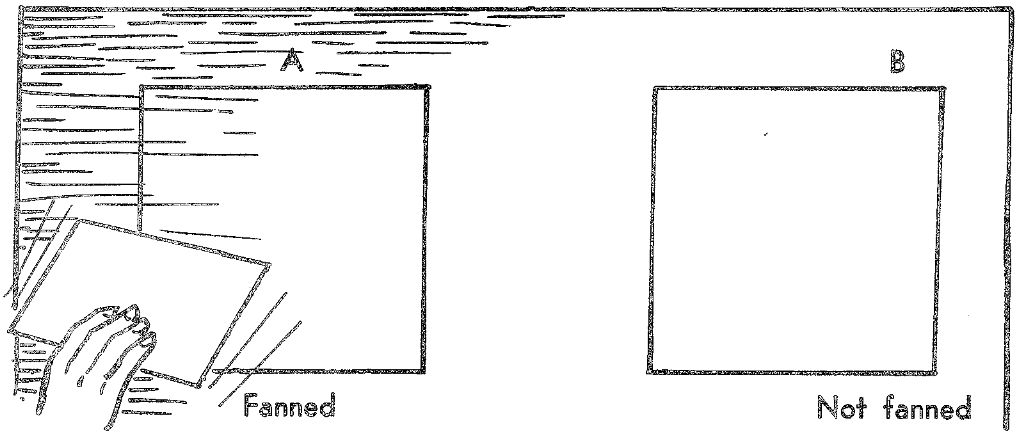
Why? ....

Heat helps water evaporate.



Show which tin still has water in it.

Experiment. Draw two 12-inch squares on the blackboard. Wet each square with a damp sponge. Fan one square with a piece of cardboard.



Which square dries quicker, A or B? ....

Why? ....

Wind helps water evaporate:

Put 1 after the best drying day, 2 after next best and so on with 3 and 4.

Cool cloudy day [ ]

Hot sunny day [ ]

Warm windy day [ ]

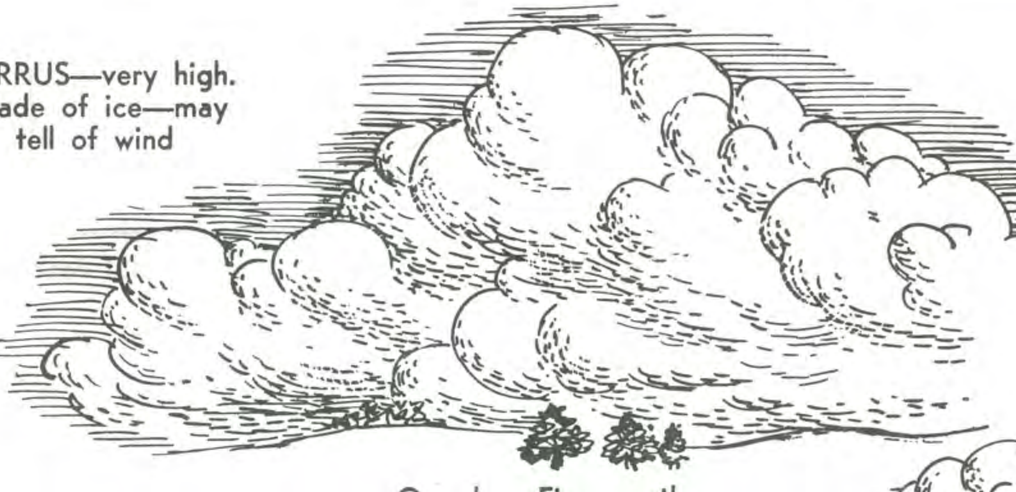
Cool windy day [ ]

CLOUDS

Clouds have different shapes and are different heights in the sky. They are weather signs. By looking at the clouds we can learn something about the coming weather. You should learn the names of some clouds.

CIRRUS—very high.
Made of ice—may
tell of wind

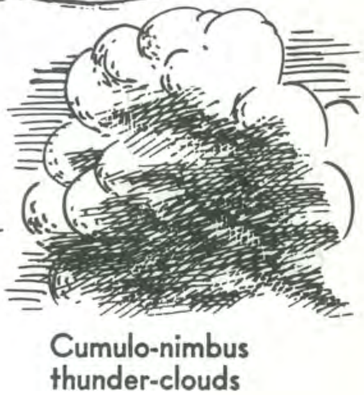
Cirro-stratus



Cumulus—Fine weather

Stratus—Evening
clouds—fine
weather

Nimbus—Rain



Cumulo-nimbus
thunder-clouds

HOT OR COLD

Can you tell if a thing is hot or cold?.......................... How?..........................

....

Have you ever left an axe or a hammer in the sun? Which feels hotter, the head or the handle?..

Really both are equally hot. They both have the same TEMPERATURE.

You cannot always tell how hot a thing is by feeling it.

Experiment. You need three dishes. In one place hot water. In the second place warm water. In the third place ice-cold water.

Place your left hand in the hot water.

Place your right hand in the cold water.

Keep them there for 10 seconds. Then place them both in the warm water.

How does this feel to your Left hand? ....

How does it feel to your Right hand? ....

Why is this so? ....

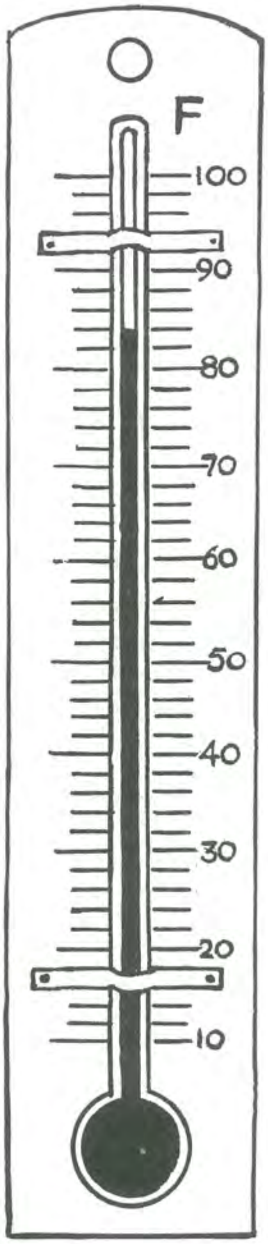
....

Feeling is not always a good way of telling the temperature of anything.

To find the temperature of anything we use a THERMOMETER.

THERMOMETERS

Here is one kind of THERMOMETER.



The back is made of wood. There is a glass tube with a bulb at the bottom. The top is closed. The bulb has a liquid in it. The liquid moves up and down the tube. The liquid in this thermometer is red methylated spirits. Sometimes there is a shiny liquid called mercury in thermometers.

The marks are called DEGREES, just as the marks on a ruler are called inches. We write ° for degrees. The thermometer measures degrees of hotness. When it is hotter the liquid rises. When it is colder the liquid falls. The top of the liquid shows the temperature.

Draw an arrow → to show the temperature on this thermometer. How many ° does each little mark stand for? ....

What is the temperature on this thermometer?..........°F

F stands for Fahrenheit, the name of the man who first made this kind of thermometer.

Water freezes at 32°F. Mark this place with an arrow and F.P.W.

If you have a thermometer find these temperatures.

(a) Of the air in the room. ....°F.

(b) Of the air in the shade outside. ....°F.

(c) Of the air in the sun outside. ....°F.

(d) Of the water in the cold water tap. ....°F.

(e) Of the water in the aquarium. ....°F.

(f) Of the soil in the garden. ....°F.

Keep a record of the temperature of the air in your room for 1 day.

9 a.m. ....°F. 11 a.m. ....°F.

1 p.m. ....°F. 3 p.m. ....°F.

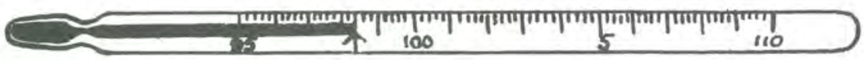
What time was the temperature highest? ....

You are going to keep records of the daily temperature for one month.

Remember:

1. Hang the thermometer outside in the shade.
2. Always take the temperature at the same time of day.
3. Always take the temperature in the same place.

Another kind of thermometer.



This is a clinical thermometer.

Your mother or the doctor uses it to take your temperature.

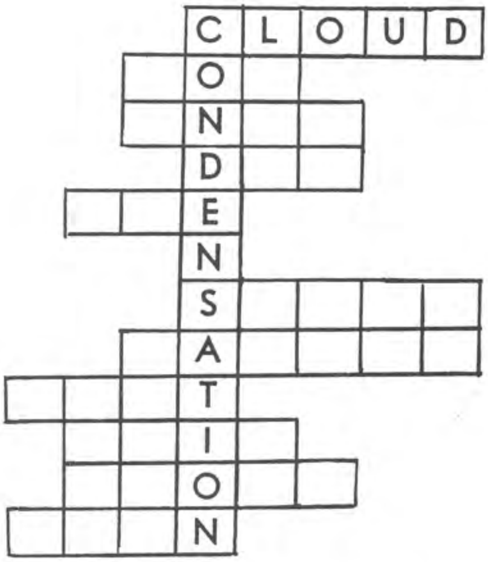
Where do they put it? ....

Find what your temperature should be if you are well. ....°F.

What happens to your temperature if you are sick? ....

PUZZLE PAGE

Water has many forms. Fill them in this pattern. The first has been done for you.



HOT AND COLD

Unscramble these words from Pages 15, 16 and 17.

PATRUTEERME — The hotness of anything.

....

TOMMETHERRE — It measures the hotness.

....

SEDREGE — A thermometer measures in them.

....

RUMYREC — A shiny liquid in some thermometers.

....

HENHERTIFA — He made the thermometer.

....

WIND

Wind is moving air.

Think of some ways you can make the air move ....

....

....

....

....

When you moved the air you made a little wind.

Later you will learn how big winds are made.

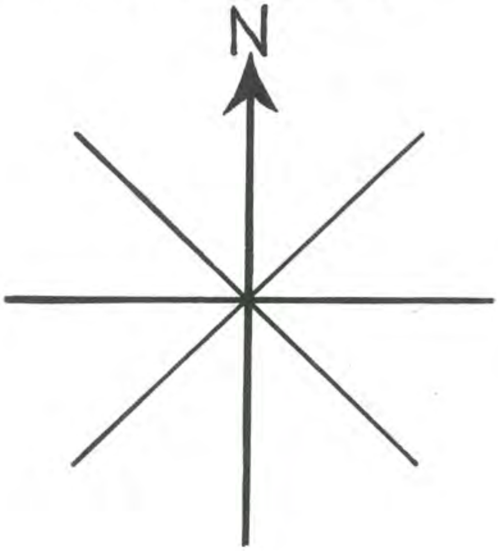
Winds blow from different directions.

We name a wind by the direction it blows from.

West winds blow from the...............................

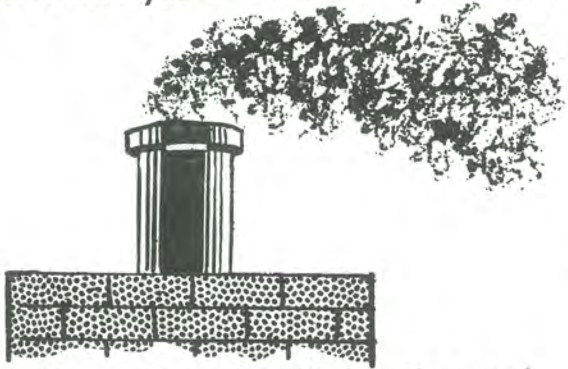
South-east winds blow from..............................

Do you know your directions. Fill them in here.



WHICH WAY DOES THE WIND BLOW?

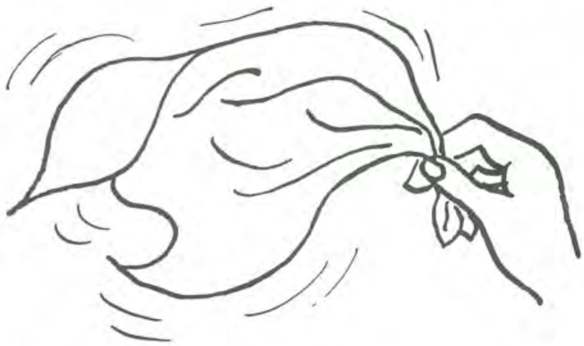
How can you tell which way the wind is blowing?



Watch the smoke from a chimney.

If the smoke is blowing to the East the wind is from the ....

Hold up a handkerchief in the wind.



If the handkerchief blows to the N.W. the wind is from the ....

Wet a finger and hold it up. The cold side will tell you which way the wind is blowing.

Can you think of some other ways? ....

....

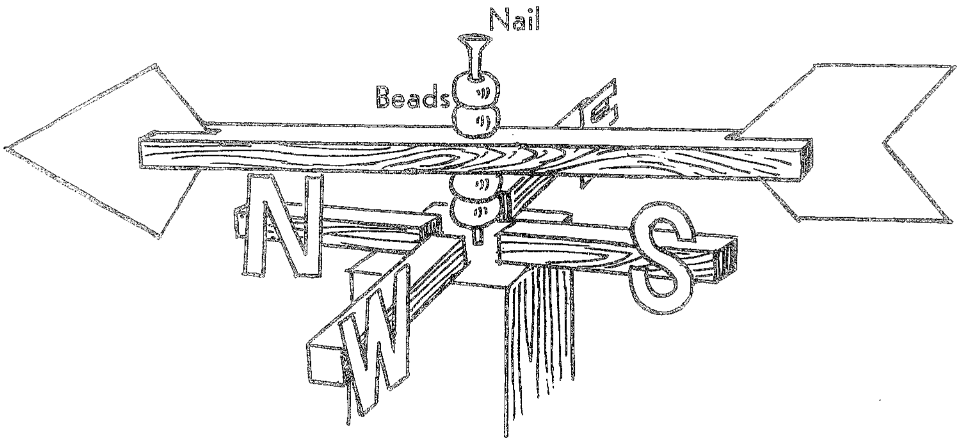
The best way is by using a wind vane. The arrow points to the direction the wind is blowing from.

You sometimes see them on top of churches. Sometimes they are called weather-cocks.

Try to find out why. ....

....

MAKING A WIND VANE



You need a piece of light wood about 12 inches long, 4 large beads, a four inch nail. You can cut the head and tail and the letters out of plywood, tin or heavy cardboard. [You will have to varnish the cardboard.] The beads help the vane to spin more easily. You fix the head and tail in slits in the wood.

Find the place to make the hole by balancing the vane on your finger. Always place the vane as high as you can so all the winds can reach it.

HOW STRONG IS THE WIND?

Try to find ways of judging how strong the wind is. Here is one way but you might think of other things.

LIGHT: Blows smoke. ....

MEDIUM: Moves leaves. ....

STRONG: Moves branches. ....

VERY STRONG: Sways trees. ....

GALE: Break off small branches. ....

MUSIC FROM METAL

Experiment. Hold a nail file firmly on a table with about half jutting out over the edge. Pull down the jutting end and let it go.

What do you see? ....

What do you hear? ....

When the nail file stops moving up and down the .... stops as well.

The movement up and down is called VIBRATION.

Sound is caused by ....

Try the same experiment with different lengths of file jutting out. Each time look and listen carefully.

The longer the piece jutting out the [higher, lower] the note.

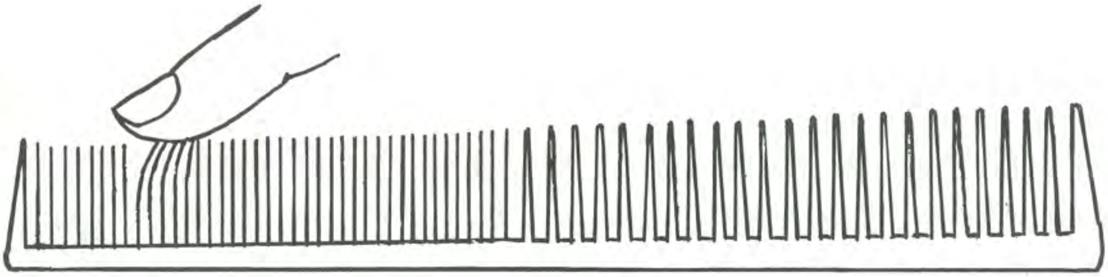
The longer the piece jutting out the [faster, slower] the file vibrates.

Try with different sized files.

The larger the file the [lower, higher] the note.

The smaller the file the [lower, higher] the note.

Experiment. Hold a comb like the one in the drawing close to your ear. Run your thumb slowly along the teeth from the small end to the large end.

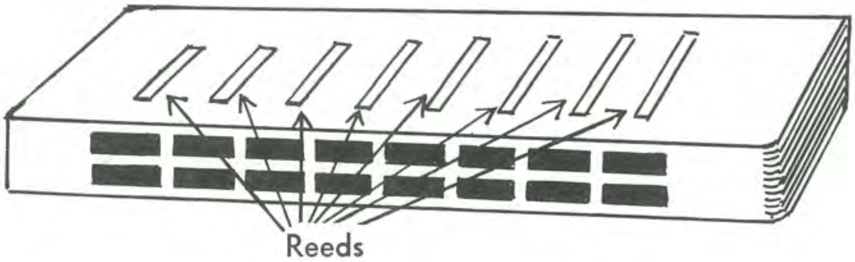


The short thin teeth give [high, low] notes.

The long thick teeth give [higher, lower] notes.

Some musical instruments have vibrating pieces of metal. They are called REEDS.

Take the metal covers off a mouth organ. Can you see the reeds?



When you blow into the mouth organ, the air makes the reeds vibrate.

The short reeds give [high, low] notes.

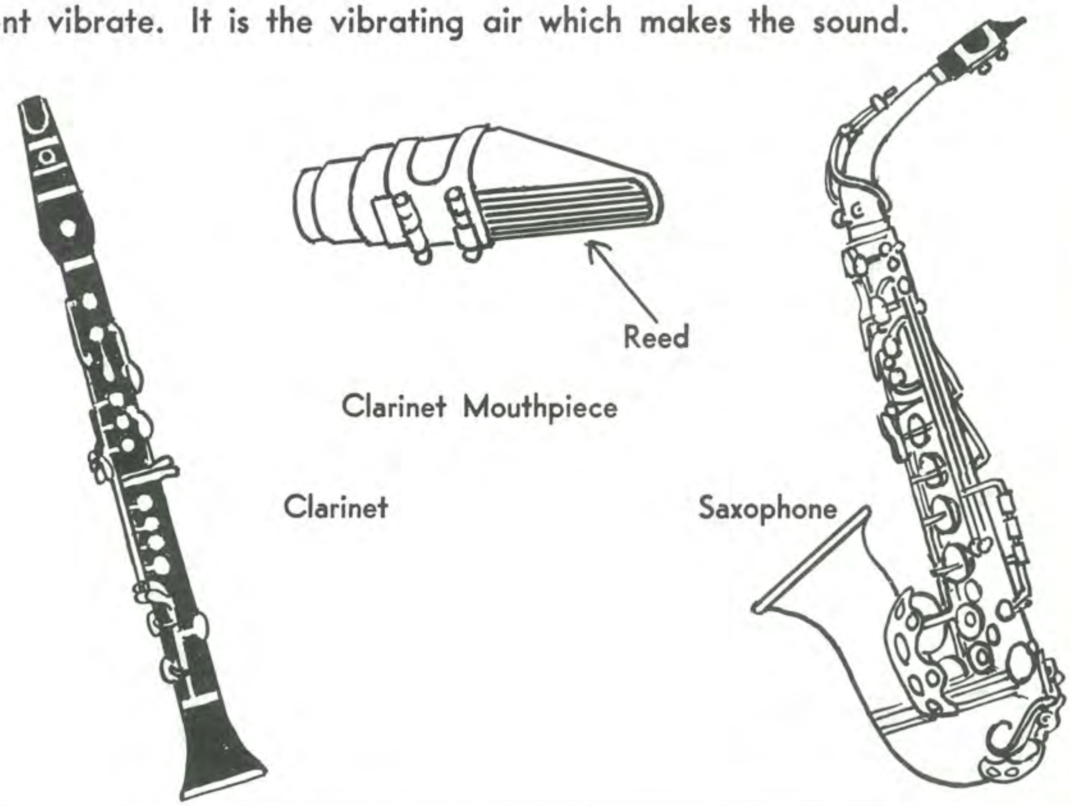
The long reeds give [high, low] notes.

Piano accordians also have reeds. When a key is pressed it lets air blow past a reed. The air is pushed past the reed by the bellows.

Some kinds of church organs also have reeds.

Some other instruments have reeds of a different kind. These reeds are made of bamboo. The clarinet and the saxophone have such a reed in the mouthpiece.

When the player blows on the reed it vibrates. The reed makes the air in the instrument vibrate. It is the vibrating air which makes the sound.



THINGS DISAPPEAR IN WATER

Experiment. Stir a teaspoonful of salt in a glass of water.

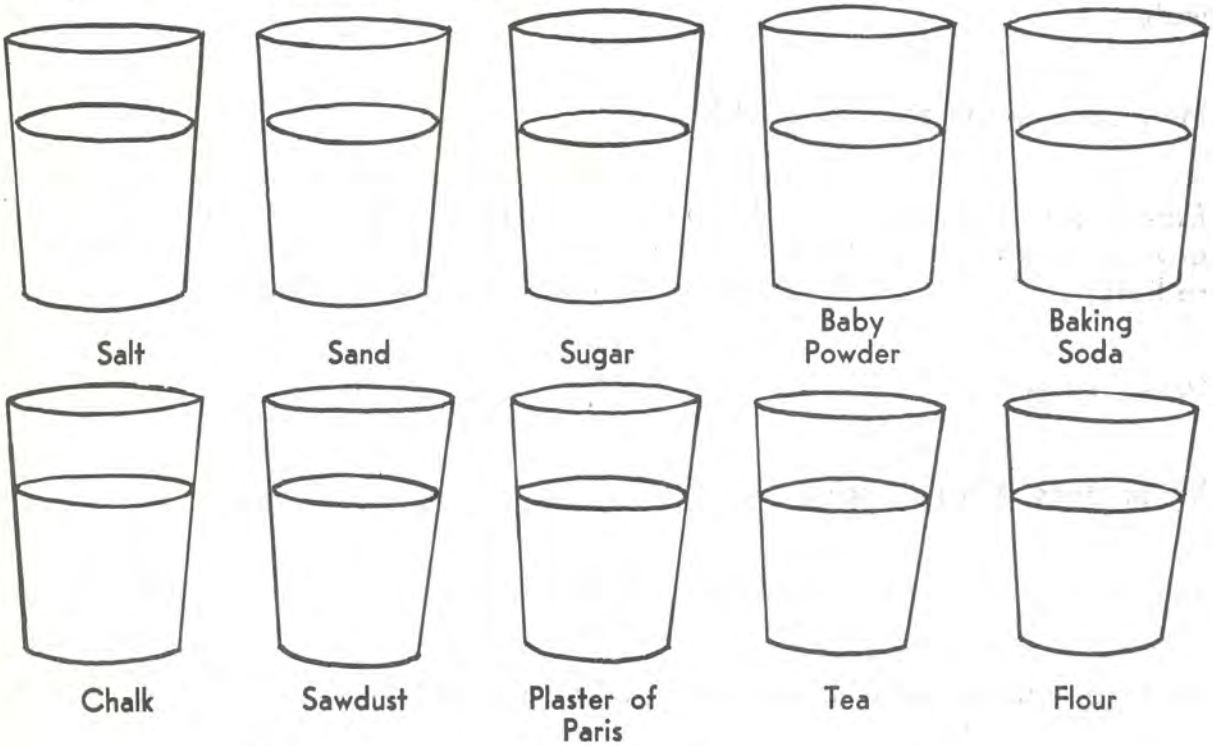
What happens to the salt? ....

Where has it gone? ....

How can you tell it is still there? ....

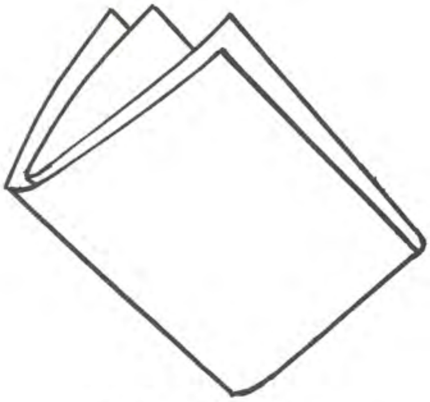
The salt has dissolved in the water.

Try the same experiment with sand, sugar, baby powder, baking soda, chalk dust, sawdust, plaster of paris, tea, flour. Underline the things which dissolve.

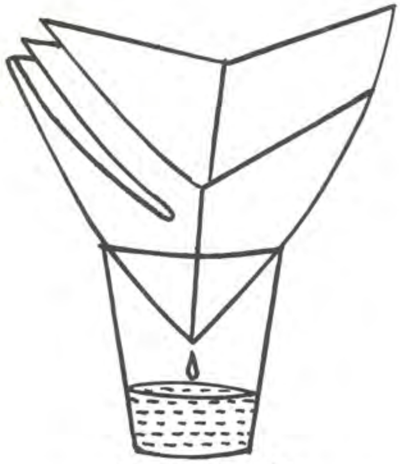


Show the powder in the ones that do not dissolve.

If you are not sure whether a thing has dissolved try to filter it out. Fold a square piece of blotting paper in four. Open it to make a funnel shape. Pour the liquid through it into another glass.



Fold the blotting paper like this



Use it like this

If any powder is left in the filter it has not been dissolved, only mixed with the water.

How can we get the salt back?

Experiment. Dissolve as much salt as you can in some warm water. Filter off any spare salt. Pour the salt water into a shallow lid. Place the lid on a radiator or in the sun. Wait until the water has evaporated.

What is left? ....

What does it taste like? ....

The .... did not evaporate. Only the .... evaporated.

How can you separate a mixture of sand and salt? ....

....

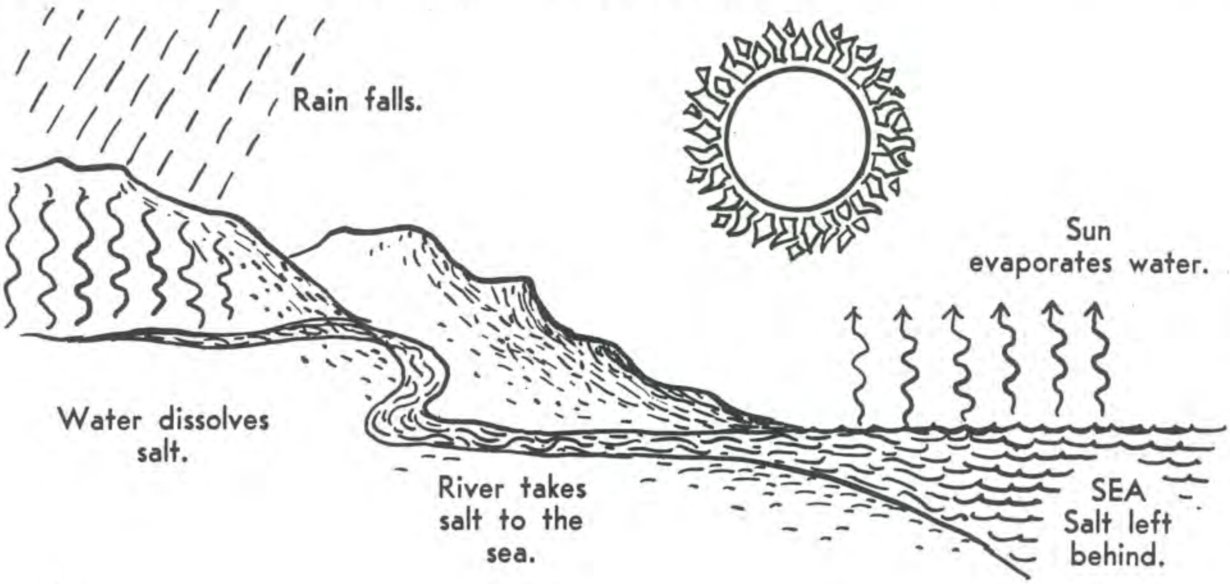
....

....

WHY THE SEA IS SALT

As water sinks or flows through the soil it dissolves many minerals. Salt is the commonest. The water flows into rivers. The rivers flow into the sea. When the sun evaporates water from the sea, the salt is left behind. The rivers keep on bringing more salt, so the sea is becoming ....

What is the name of the saltiest sea in the world? ....



Sometimes all the water in a small sea or lake evaporates and a SALT LAKE is left.

Are there any minerals in your drinking water? Let a few drops of drinking water evaporate on a piece of very clean glass. Is anything left? ....

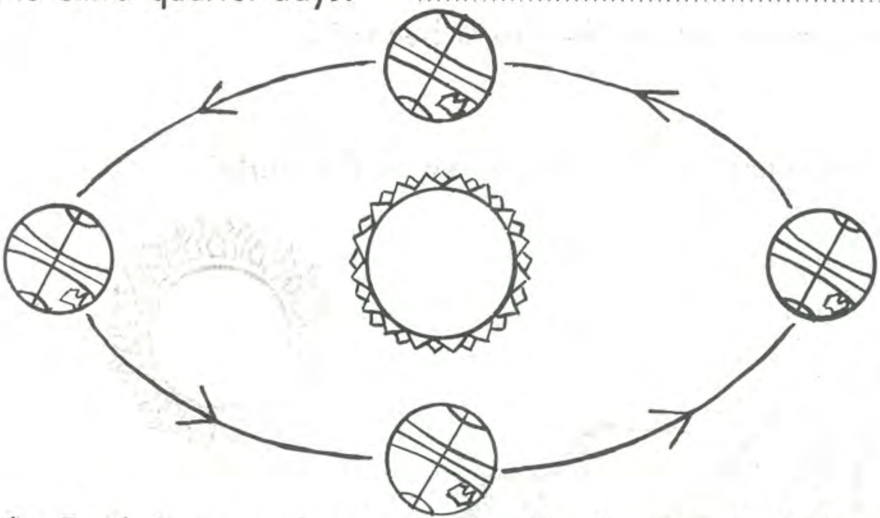
Look at it with a magnifying glass. ....

WHAT IS A YEAR?

You know the Earth spins round. The time it takes to spin is one ....

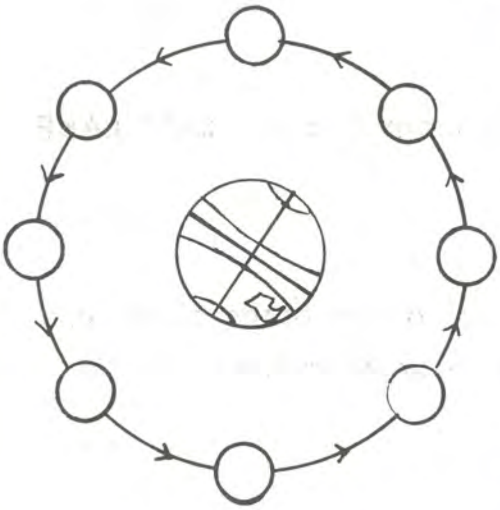
The Earth also travels round the Sun. The time it takes to do this is One Year.

Actually the time is $365\frac{1}{4}$ days. We count 365 days as one year. What do we do with the extra quarter-days? ....



The path of the Earth is an oval not a circle. The Sun is not at the centre of the oval. The Earth is closer to the Sun in December than in June. The journey of the Earth round the Sun causes the seasons. You will learn how next year.

WHAT IS A MONTH?



The Moon travels round the Earth.

The journey takes 28 days.

This is a lunar month.

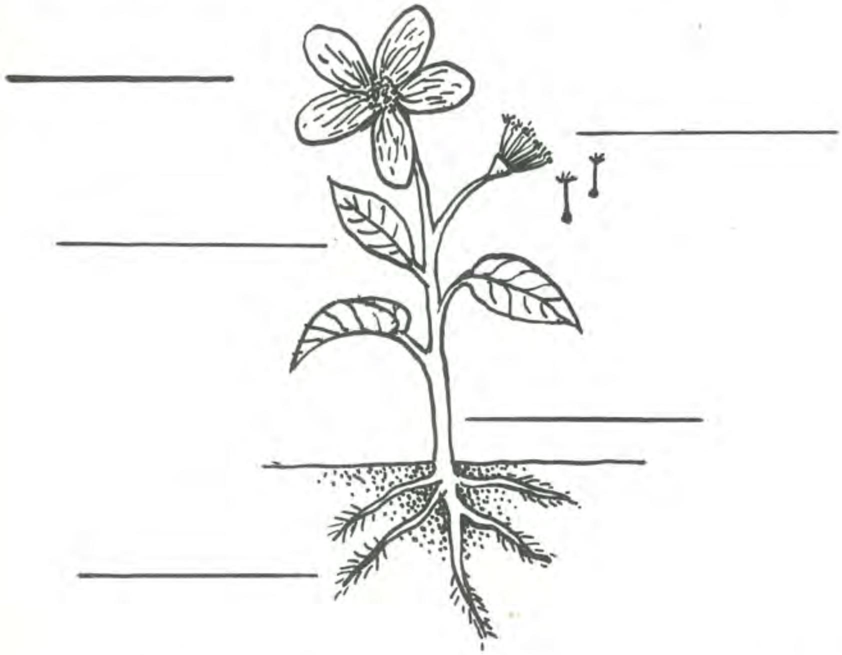
The word month was once moonth.

The word lunar is made from Luna who was the Goddess of the Moon. So lunar month is really moon month.

We talk about lunar months to distinguish them from Calendar months which have 28, 30 or 31 days.

PARTS OF A PLANT

Nearly all plants have ROOTS, a STEM and LEAVES. Most plants have FLOWERS and SEEDS at some time. Name all the parts in this plant.



Not all plants have ROOTS, STEM and LEAVES. Here are three plants that do not have them. Can you name them.

Perhaps you can find some others. ....

....

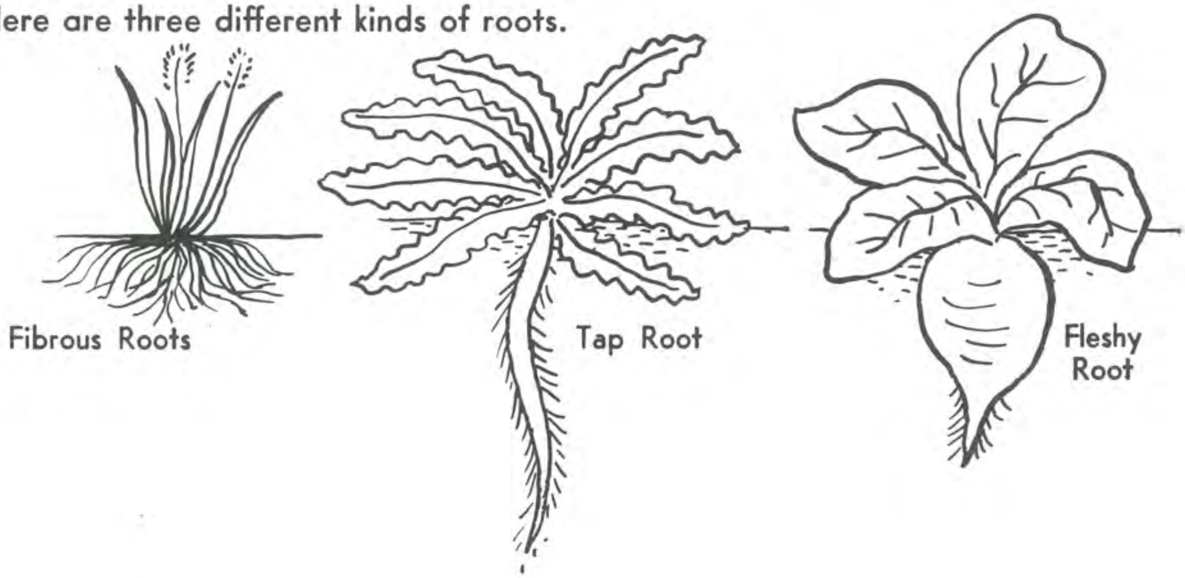
WHY PLANTS HAVE ROOTS

Plants need roots to hold them in the ground. Trees have many very strong roots.

Many grasses have a very large number of roots like strong thread.

Some plants store food in their roots.

Here are three different kinds of roots.



Find some plants with each of these different kinds of roots.

Fibrous ....

Tap ....

Fleshy ....

There are other kinds of roots. See if you can find plants with them. Draw them below.

WHY PLANTS HAVE ROOTS

Plants need water. A plant which is not watered will wilt and finally die.

Experiment. Carefully pour water on the soil round a wilted plant. Make sure none goes on the leaves. What happens after a while? ....

Before Watering

After Watering

Of course, if the plant had wilted too much it may not revive.

The plant has taken in water through its roots.

Experiment. Carefully pull up a small healthy weed plant. Wash the roots. Place the plant in a bottle of red ink. Watch it for two days. What happens?

....

Before

After

Colour the Pictures

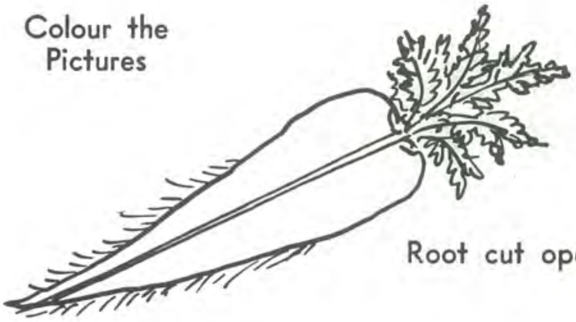
The roots have taken in not only the water but also the red colouring dissolved in the water.

A carrot or a parsnip is a large root.

Experiment. A fresh young carrot or parsnip straight from the garden is best for this experiment. If you have to use a "droopy" one cut off the bottom tip and place it in clean water for a few hours before trying the experiment.

Leave the leaves on. Place the parsnip or carrot in red ink. Leave it in the sun-light for several hours. Then cut it down the middle. What do you see?

Colour the Pictures

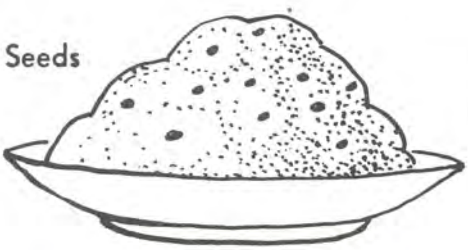


Root cut open

Actually the water is taken in by the root hairs. These grow out from the roots a little way from the tip.

Make a mound of cotton wool in a saucer. Wet it well. Sow some radish seeds on the cotton wool. Cover with a basin. Roots grow best in the dark. After two days the roots should have grown. Look for the root hairs. Draw what you see.

Seeds



Cotton Wool

Water

Seed o

Some-one has worked out that the total length of roots and root hairs on a maize plant is 300 miles.

WHY PLANTS HAVE STEMS

The STEM supports the plant so that the leaves can get light and air. There are many kinds of stems. Most plants have soft stems.

TREES have ONE woody stem. Name some trees.

....

....

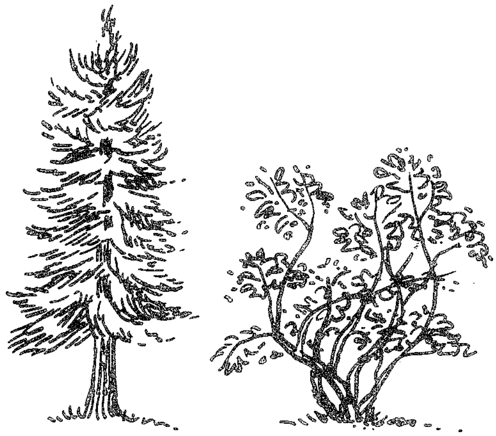
....

SHRUBS have SEVERAL woody stems. Name some shrubs.

....

....

....



Tree   Shrub

Most plants have rounded stems. Name some. ....

....

Some plants have square, flat or fluted stems. Find and name one of each kind.

Square.............................. Flat.............................. Fluted..............................

Name some plants with climbing stems. ....

....

Name some plants with creeping stems. ....

....

Name some plants with hollow stems. ....

....

Draw some stems here.

WHY PLANTS HAVE STEMS

Experiment. Place a fresh grape vine twig with some leaves on it or a celery shoot in red ink. Leave them for some hours. Cut each across. Draw what you see.

Grape Vine

Celery

Cut down the centre of the grape vine twig and scrape off the outside of the celery. Draw what you see.

Grape Vine

Celery

The water is carried along tubes in the stem to the leaves.

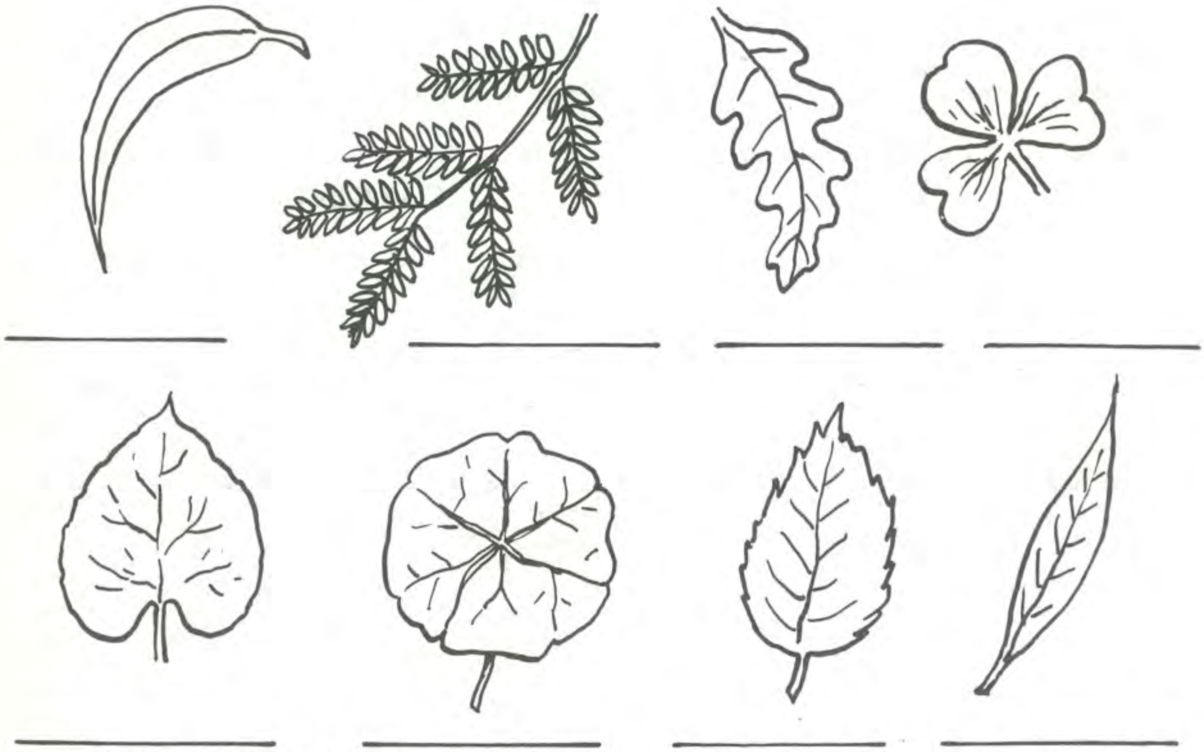
Place some flower stems in coloured water. Arum lilies, daffodils, white geraniums, white carnations are good to try. It will help if you cut the bottom of the stem off under water.

You could try splitting the stem part way up and putting each half into different coloured water. Make sure the colour is really dissolved in the water.

WHY PLANTS HAVE LEAVES

Leaves are of many shapes. Some are drawn for you. See if you can name them from the list given.

Violet, clover, gum, wattle, nasturtium, rose, dandelion, wallflower.



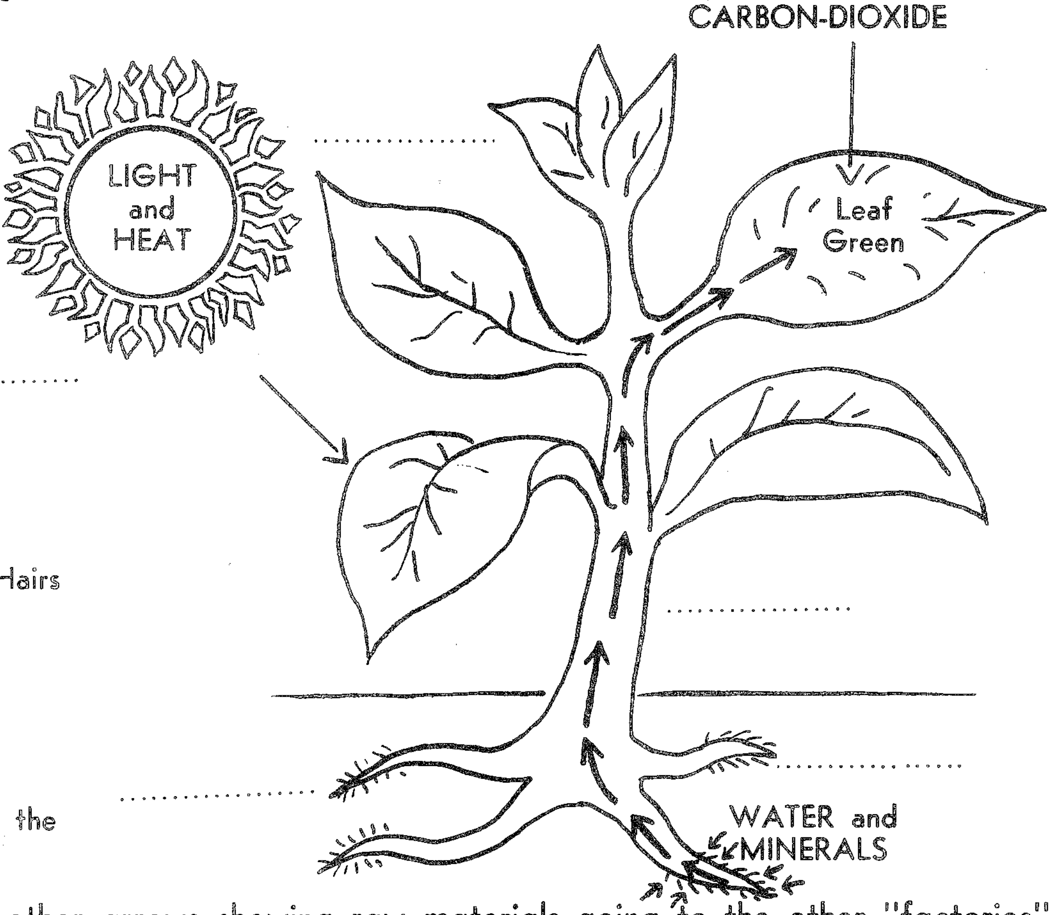
Now in the space below draw some interestingly-shaped leaves you have found.

WHY PLANTS HAVE LEAVES

The leaf is the "food-factory" of the plant. The food of the plant is made in the leaves.

To make food the leaf needs:

1. Water and dissolved minerals from the soil.
2. Carbon-dioxide gas from the air.
3. Green in the leaves. The proper name is chlorophyll.
4. Light and heat from the sun.



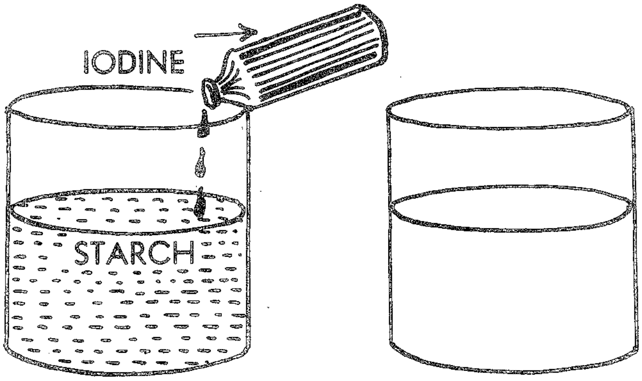
Name
Root Hairs
Roots
Stem
Leaves
Sun
Colour the Picture

Draw other arrows showing raw materials going to the other "factories".

HOW LEAVES MAKE FOOD

The leaves join water and carbon-dioxide to make STARCH. This is a part of many foods we eat. We can always find if there is starch in this way.

Experiment. Mix some washing starch and water into a paste. Heat it gently till it goes thick. Let it cool. Add a few drops of iodine and stir it.



Colour to show what happens

Whenever we put iodine on cooked starch it always turns it BLUE. This means we can always find out if anything contains starch. Put weak iodine on bread, biscuit, cooked potato, porridge, meat, cheese, boiled milk, toffee, butter.

Underline the ones that contain starch. Weak iodine is iodine and water. Now we are ready to do some experiments with leaves.

Experiment.

1. Pick some green leaves on a sunny afternoon. They should be soft leaves. Nasturtium leaves are very good.

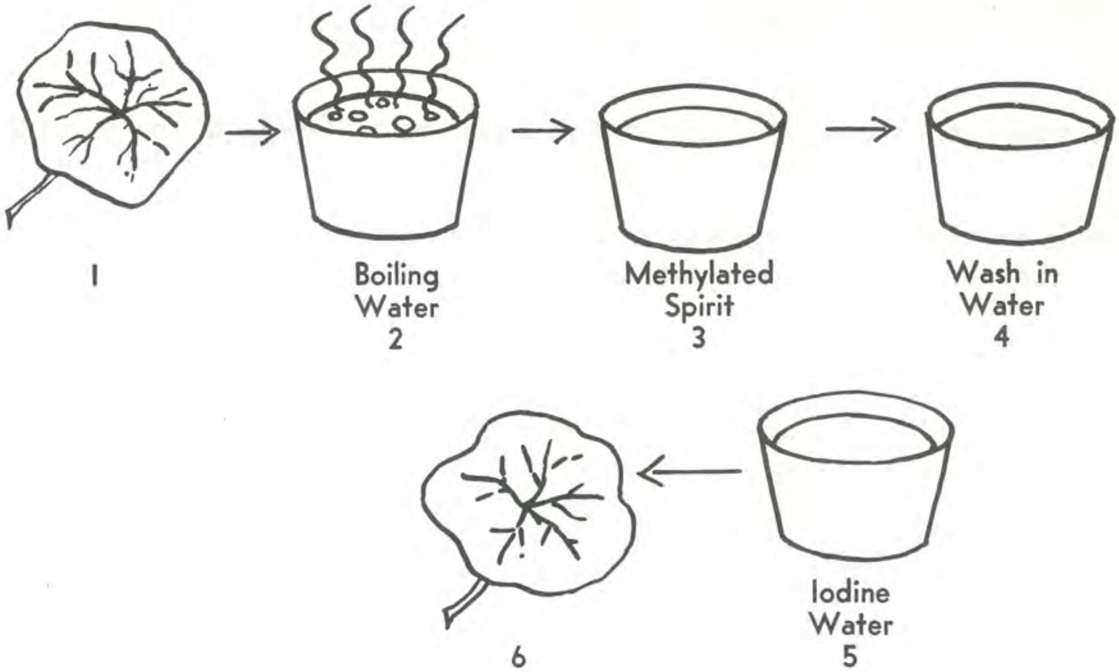
2. Place them in boiling water for two or three minutes.

3. Soak them in methylated spirit for two days. This takes out the green colour.

4. Wash out the methylated spirits.

5. Put the leaves in water with enough iodine to make it yellow.

6. Look at them next day.



The leaves turn blueish showing that there is .... in them. The .... made the starch.

Experiment. Repeat the experiment using some leaves picked very early in the morning. What do you notice? ....

The leaf needs sunlight and heat to make starch.

You can show this even better this way.

Experiment. Cover a leaf on a plant with aluminium foil with a word or pattern cut out of it. Leave it for a day and pick it in the late afternoon. Test it for starch as before.

Where does the leaf turn blue? ....

HOW LEAVES MAKE FOOD

You can show that leaves need leaf-green [chlorophyll] to make starch in this way.

Experiment. Find a variegated [green and yellow] leaf and test it for starch as before. Which part of the leaf makes starch? ....

Variegated Leaf

Colour blue and yellow

PLANTS STORE FOOD

The food made in the leaves passes along the stem to other parts of the plant.

Plants use some of the food but they make more food than they use every day. They store the extra food. Some store the food as STARCH. Some change it to SUGAR. Some change it to OIL.

List these plants according to the way they store their extra food.

Wheat, potatoes, grapes, peanuts, olives, rice, sugar-cane, coconuts, beetroot.

STARCH ....

SUGAR ....

OIL ....

WHERE PLANTS STORE FOOD

Different plants store the extra food in different parts of the plant. Some store it in the ROOTS, some in the STEM, some in the SEEDS, some in the LEAVES, some in the FRUITS, some in the FLOWER. Some store it in more than one part.

Place each of these plants in its proper place according to where it stores food.

You will have to think hard about some of them and you may need help from books or other people.

Carrot, sugar-cane, wheat, cabbage, parsnip, rhubarb, potato, peach, grape, onion, pea, peanut, beetroot, celery, coco-nut, sweet-potato, cauliflower.

ROOTS ....

STEM ....

SEEDS ....

LEAVES ....

FRUIT ....

FLOWER ....

In these foods is stored ENERGY from the SUN.

Animals, including MAN, eat the foods made by plants and obtain and use this ENERGY. Some animals eat the plants. Others eat other animals which have eaten plants. Some animals do both.

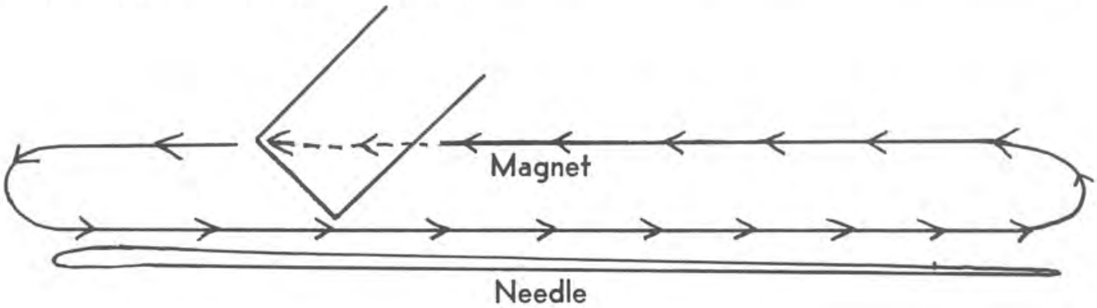
Plants like mushrooms which have no green leaves cannot make food. They live on dead plant or animal material in the soil.

FUN WITH MAGNETS

Have you played with a magnet? .... If you have not, you have missed a great deal of fun.

You can buy magnets. You can often get them from old loud speakers or telephones. If you have a friend who has a magnet you can make one of your own.

You need a steel knitting needle. Stroke the needle with ONE end of the magnet. Do not stroke the needle back and forward. Start at one end and stroke to the other. When you come to the other end, lift up the magnet and start again. Stroke 20 times.



Test your magnet by seeing if it will pick up a paper clip or a needle.

Magnets will only pick up certain things.

Experiment. Which of these things will your magnet pick up? Underline the things it will pick up. Needle, pin, screw, penny, threepence, paper, chalk, drawing pin, match, small key, pen-nib, small nail, tack, sand, rubber, marble, stamp.

It may pick up some screws and pins and not others. See if you can find out why. ....

Magnets will only pick up things made of .... and ....

These are called MAGNETIC materials.

Other materials are NON-MAGNETIC.

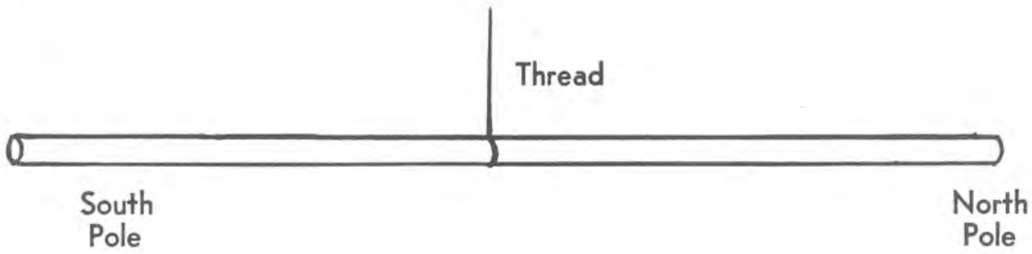
Some magnets have N on one end and S on the other.

N stands for NORTH POLE.

S stands for ....

You can find which is the North Pole of the magnet you made.

Experiment. Hang your magnet up by a thread. Let it turn until it stops. Note which end points to the North. This is the North Pole. Mark it with a dab of paint.



Experiment. Bring another magnet near the hanging magnet.

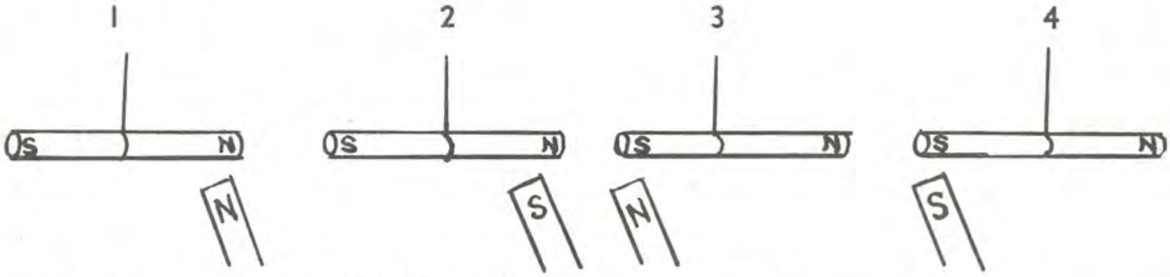
(1) North Pole to North Pole.

(2) South Pole to North Pole.

(3) North Pole to South Pole.

(4) South Pole to South Pole.

See what happens each time.



Draw arrows to show which way the hanging magnet moves.
ATTRACTS means comes closer. REPELS means moves away. Write in attracts or repels.

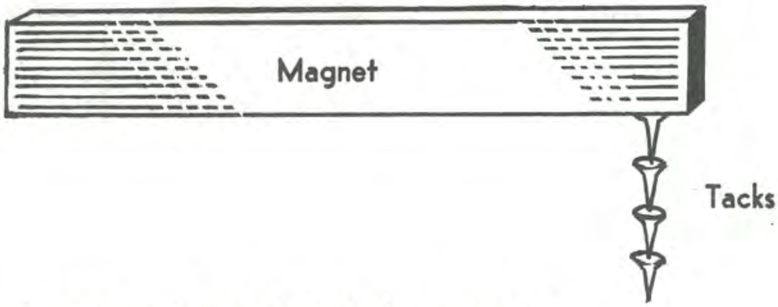
North Pole .... North Pole. South Pole .... South Pole.

North Pole .... South Pole. South Pole .... North Pole.

Experiment. Pick up one paper clip or tack with your magnet. Touch another clip or tack to the bottom of the first. What happens? ....

.... Why is this so? ....

.... Touch another tack to the second and so on until you have a chain.



Take the top tack or clip off the magnet.

What happens to the others? ....

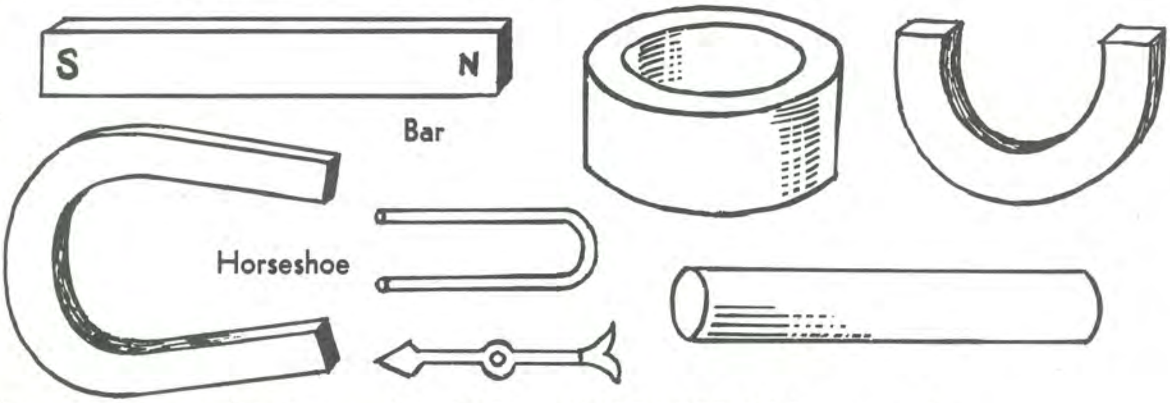
Why? ....

While the clip or tack was touching the magnet it was a magnet. So it could hold the next one and so on. The tacks may stay magnets for a little while. But they will soon lose their magnetism.

They were TEMPORARY magnets.

Yours is a PERMANENT magnet.

There are several shapes of magnets. Here are some.



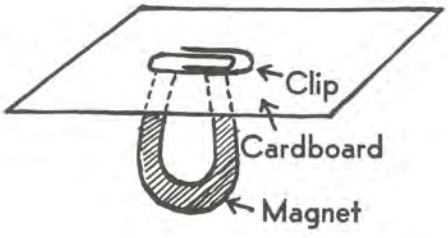
The commonest kinds are the BAR and HORSESHOE magnets.

Experiment. You will need a strong magnet for the next experiments. Place a paper clip on a piece of thin cardboard. Move a magnet under the cardboard.

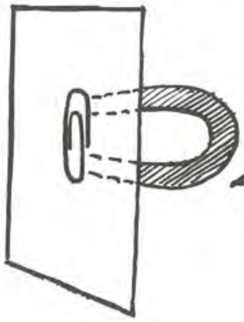
What does the paper clip do? ....

....

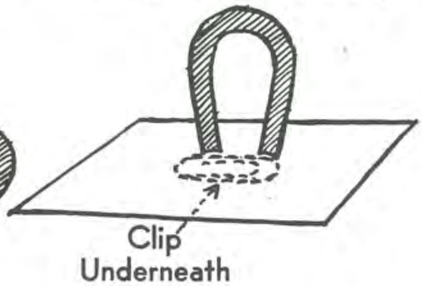
Turn the card sideways and make the clip move up and down. If your magnet is strong enough you may be able to hold the cardboard by attracting the clip as in the third picture.



1



2



3

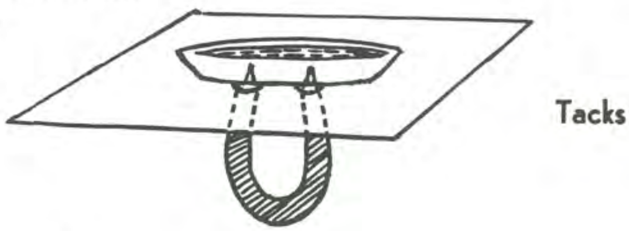
Try the same experiment with a tin lid instead of the cardboard. What do you notice? ....

....

You could also try the experiment with a piece of thin plywood, a sheet of thin glass. a sheet of plastic.

Magnets exert a force. The force is called MAGNETISM. Magnetism will pass through non-magnetic materials.

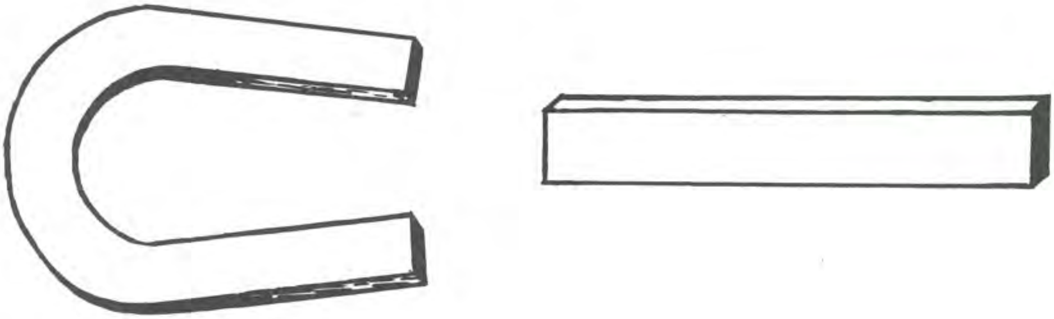
Carve a small car or a boat out of balsa wood. Push two tacks in the bottom of it. Make it move on a piece of cardboard
by moving a magnet underneath.



For the next experiments you need some iron filings. You may be able to get some from an engineering works or a machine shop. You may be able to buy them at a hobby shop or you can make some by filing a large nail.

Experiment. Push your magnet in some iron filings. If it is a bar magnet you will have to push each end in separately.

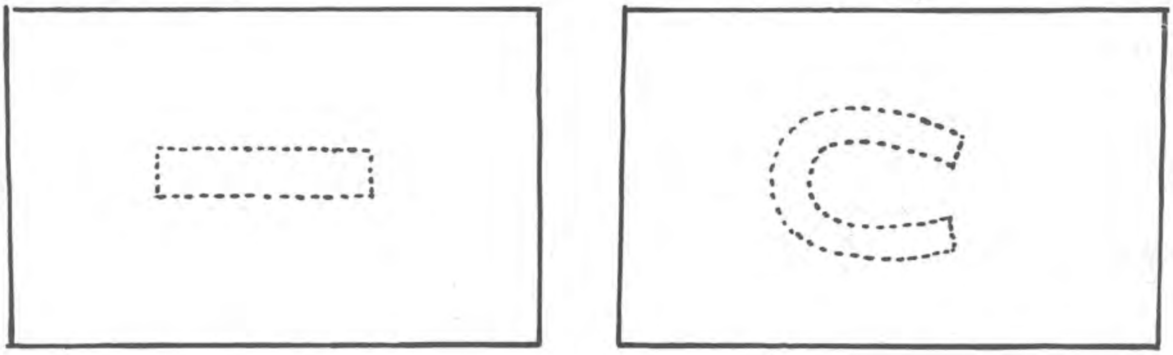
Show where the filings stick to the magnet.



Where are the filings thickest? ....

Where is the pull of the magnet strongest? ....

Experiment. Place a magnet on a table. Place a sheet of paper over it. Sprinkle some iron filings evenly over the paper. Tap the paper gently. Draw the pattern the filings make.

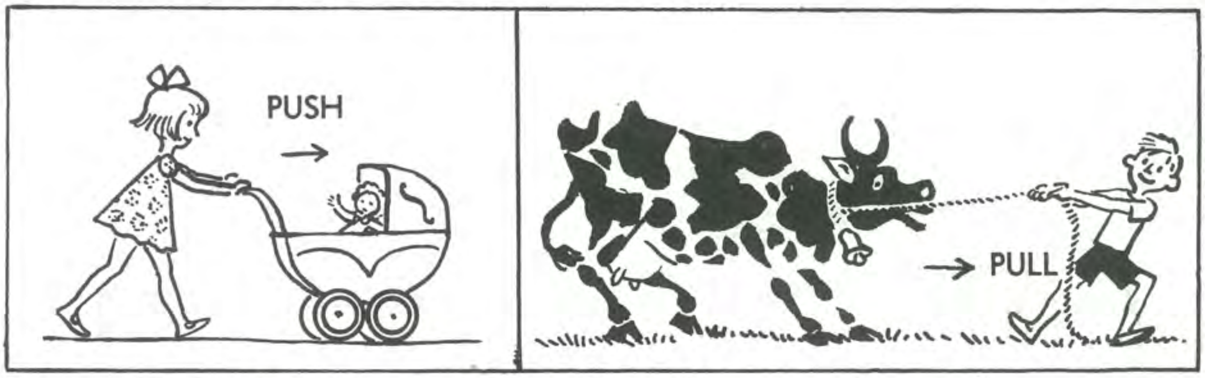


The pattern of the filings shows the force of the magnet. Where is force strongest? ....

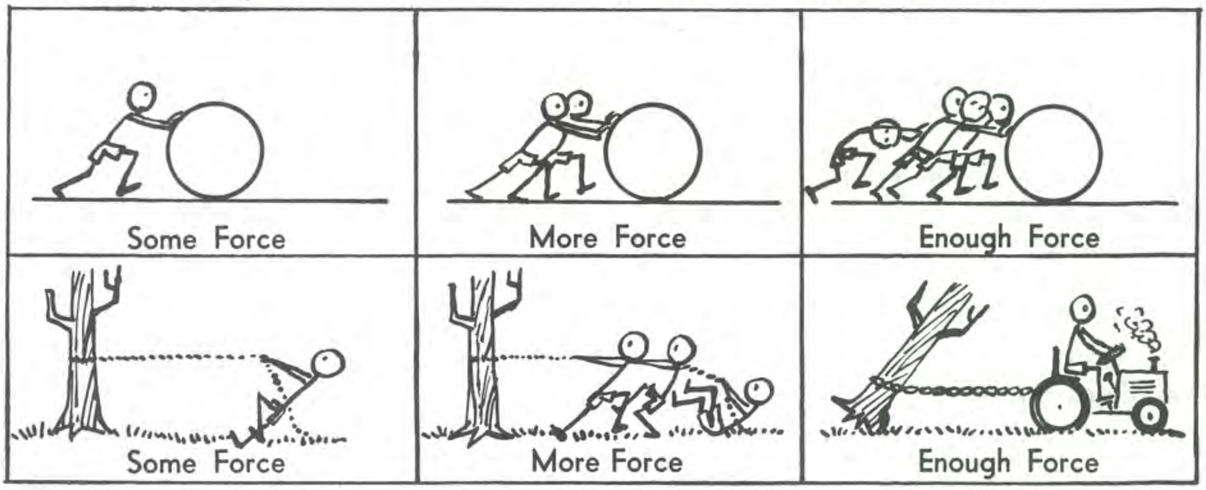
You can make some interesting patterns with two magnets. Try placing the magnets in different ways.

FORCE

FORCE is a PUSH or a PULL.

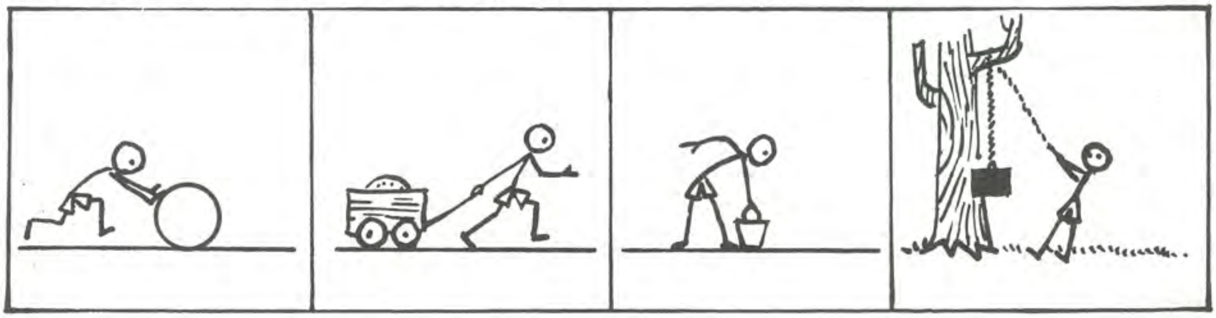


If we use enough force we can move the thing we push or pull.



The thing will move in the direction of the force.

Draw arrows to show which way the thing will move.



MAKING THINGS MOVE FASTER

Experiment. Hang a weight by a string 2 feet long from a nail. Make sure it can swing without touching anything. Make the weight swing by pushing it VERY GENTLY. Each time it swings back push it VERY GENTLY. Try to make all your pushes the same.

Draw what happens to the weight.

After each push the weight goes .... and ....

The pushes make the weight move faster.

You can try the experiment in a bigger way by pushing your mate on a swing.

Try to make all your pushes the same.

Push just as the swing starts to move away from you.

If you have been on skates you will know that you have to keep pushing. Each push makes you go [faster, slower]. Cross out the wrong word. Force is needed to make a moving thing ACCELERATE. Accelerate means make go

....

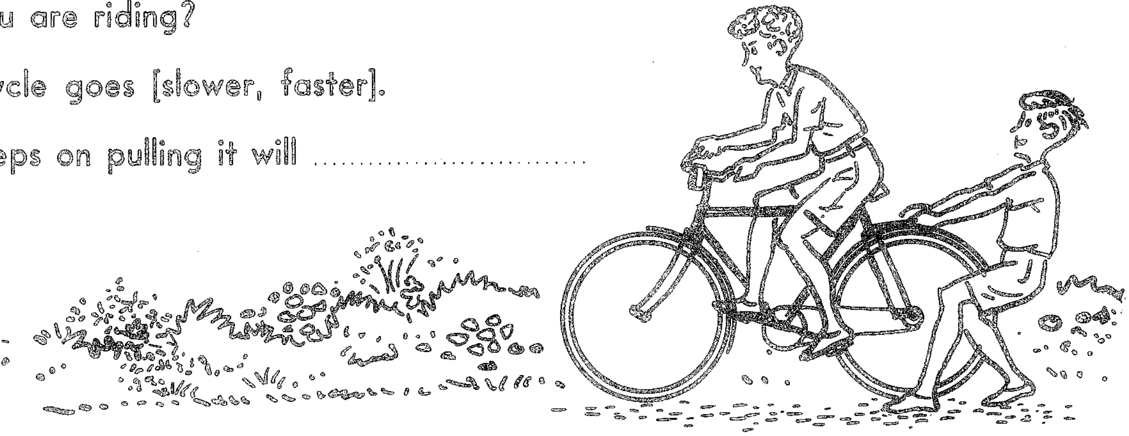
To make a moving thing accelerate the force must be [in the same direction/ the opposite direction] as the way the thing is moving.

MAKING THINGS MOVE SLOWER

What happens if someone grabs the back carrier of your bicycle and pulls while you are riding?

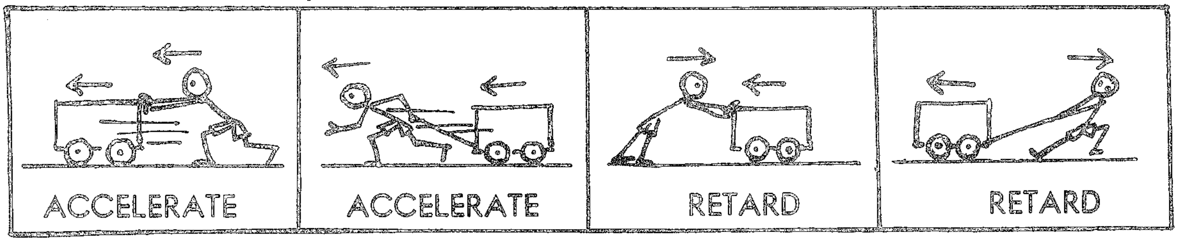
The bicycle goes [slower, faster].

If he keeps on pulling it will ....

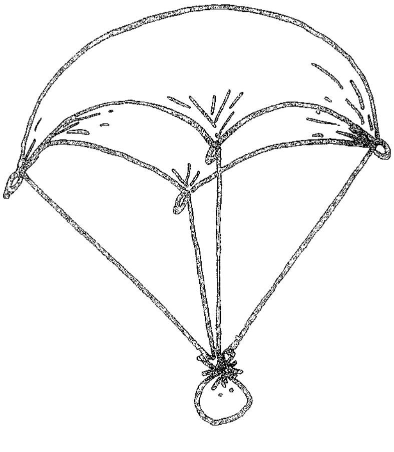


Force is needed to RETARD a moving thing. RETARD means make go [slower, faster].

To retard a moving thing the force must be [in the same direction, the opposite direction] to the way the thing is moving.



Experiment. Make a parachute by tying lengths of string to the four corners of a handkerchief. Tie the strings to a small weight. Roll up the parachute and throw it into the air.



Before the parachute opens the weight falls

....

After the parachute opens the weight falls more ....

Show by arrows:

(a) The direction the weight is moving. →

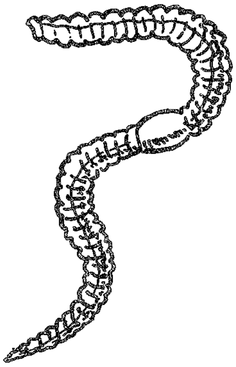
(b) The direction of the retarding force. →

GROUPS OF ANIMALS

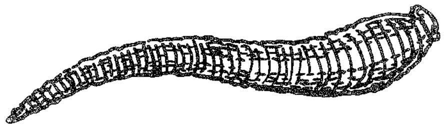
Animals are arranged in GROUPS. All the animals in one group are alike in some way. Some of the main groups of animals are listed here. You will certainly be able to find some animals in each group to study. There are some pages for you to write down and draw what you find out. You can record such things as:

Where you found it. How it moves. What kind of covering it has. What it eats. Is it harmful or useful. Does it lay eggs? What do the young ones look like. Any other interesting things you can find out. Keep your records carefully and write down only what you discover.

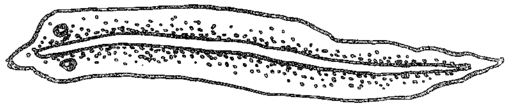
WORMS



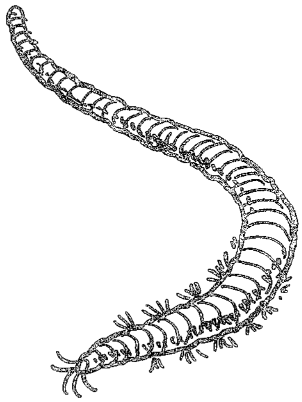
Earthworm



Leech



Flatworm



Beachworm

All worms have long soft bodies. Many worms have rings but some are flat.

The flat worm lives in damp places and shallow pools. A piece of meat will often attract it. There is a very large earth worm in Victoria. It may be 8' long. Some worms live inside other animals.

Silk worms, glow worms, slow worms, and wire worms are not worms. Can you find out what they are?

MOLLUSCS

Garden Snail

Slug

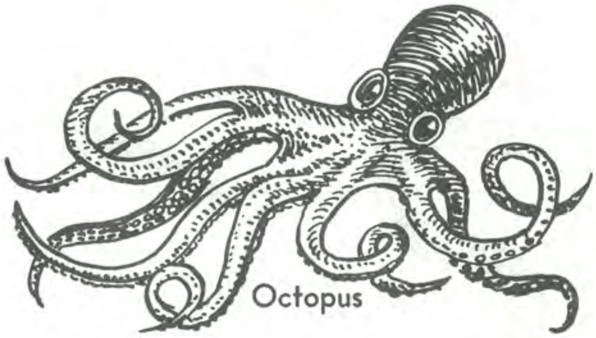
Limpet

Periwinkle

Cowry Shell

Freshwater Mussel

Oyster



Octopus

Molluscs all have soft bodies. Many of them build shells to protect themselves. Some have a single shell. Some have a double shell. A few have no shell. Most molluscs live in water.

SEA-STARS

Starfish

Brittle Star

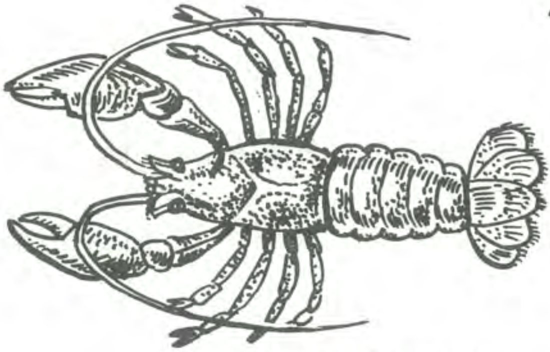
Pentagon Star

Sea Urchin

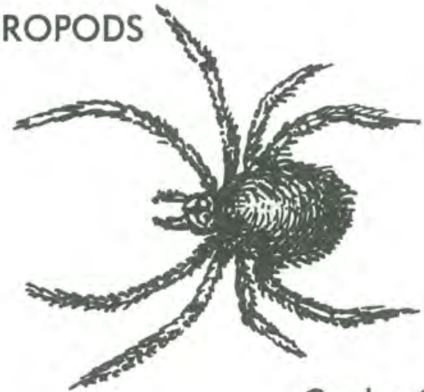
Sea-stars all have spiny skins. They have tube feet which they fill with sea-water.

Sea-stars usually have five arms but some have more. If they lose an arm they can grow another one. Sea-urchins belong to the same class. You may have found the skin of a sea-urchin on the beach.

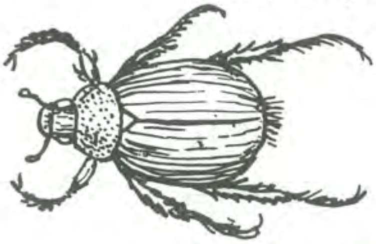
ARTHROPODS



"Yabbie" or
Freshwater Crayfish



Garden Spider



Christmas Beetle

Emperor Gum Moth

Tick

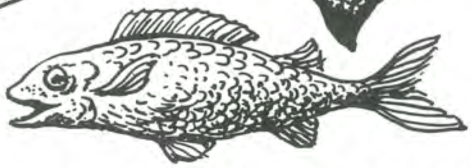
Centipede

All Arthropods have jointed legs. There are more animals in this group than in all the other groups put together. It includes crabs, spiders, insects, scorpions, ticks, centipedes and millipedes. Different animals have different numbers of legs. Insects always have six legs. The animals in this group have "external" skeletons.

FISHES

Shark

Stingray



Fish

Fishes were the first animals to have backbones. Fish have gills instead of lungs. They get oxygen out of the water.

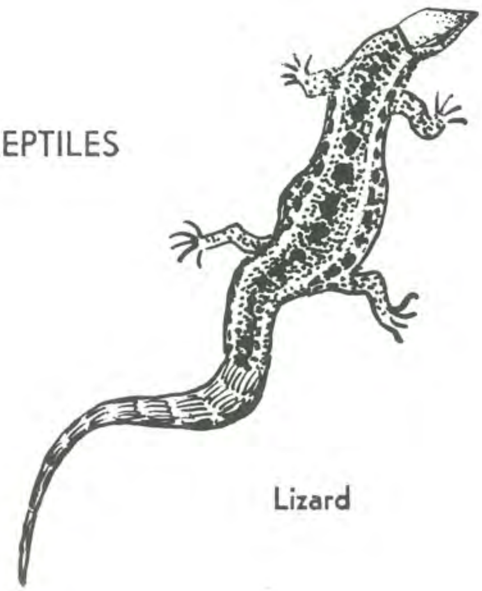
AMPHIBIANS

Frog

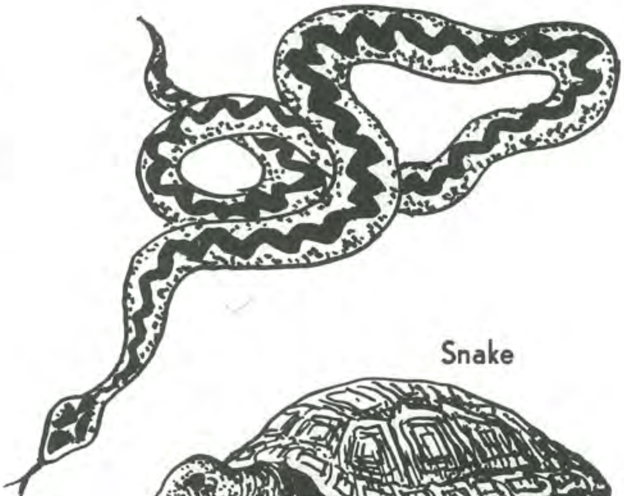
Amphibians live like fish when they are young. They live mainly on land when they are adult. They have gills when babies and lungs when adult.

Frogs and toads are amphibians.

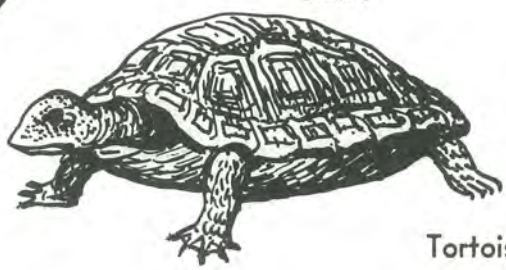
REPTILES



Lizard



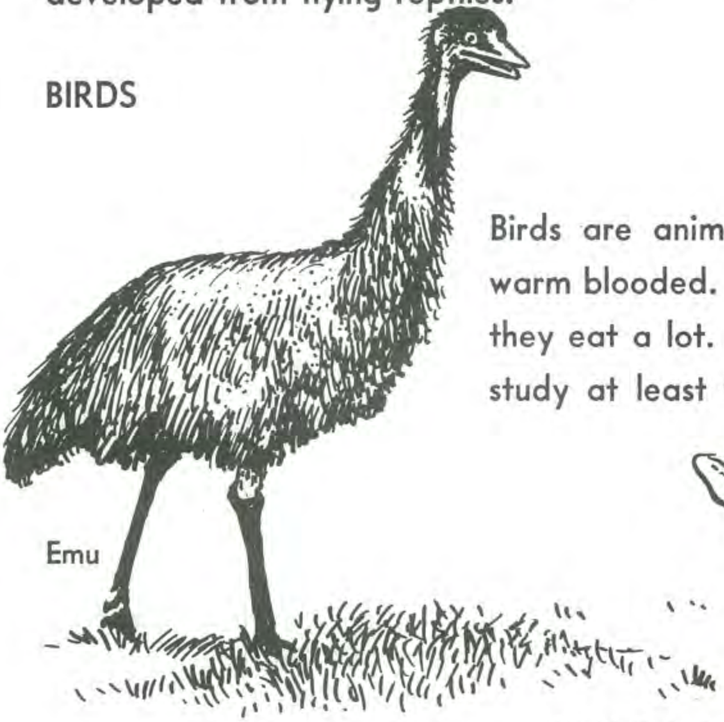
Snake



Tortoise

Reptiles have scales and lungs. Some of the largest land animals that ever lived were the giant reptiles that lived millions of years ago. Birds probably developed from flying reptiles.

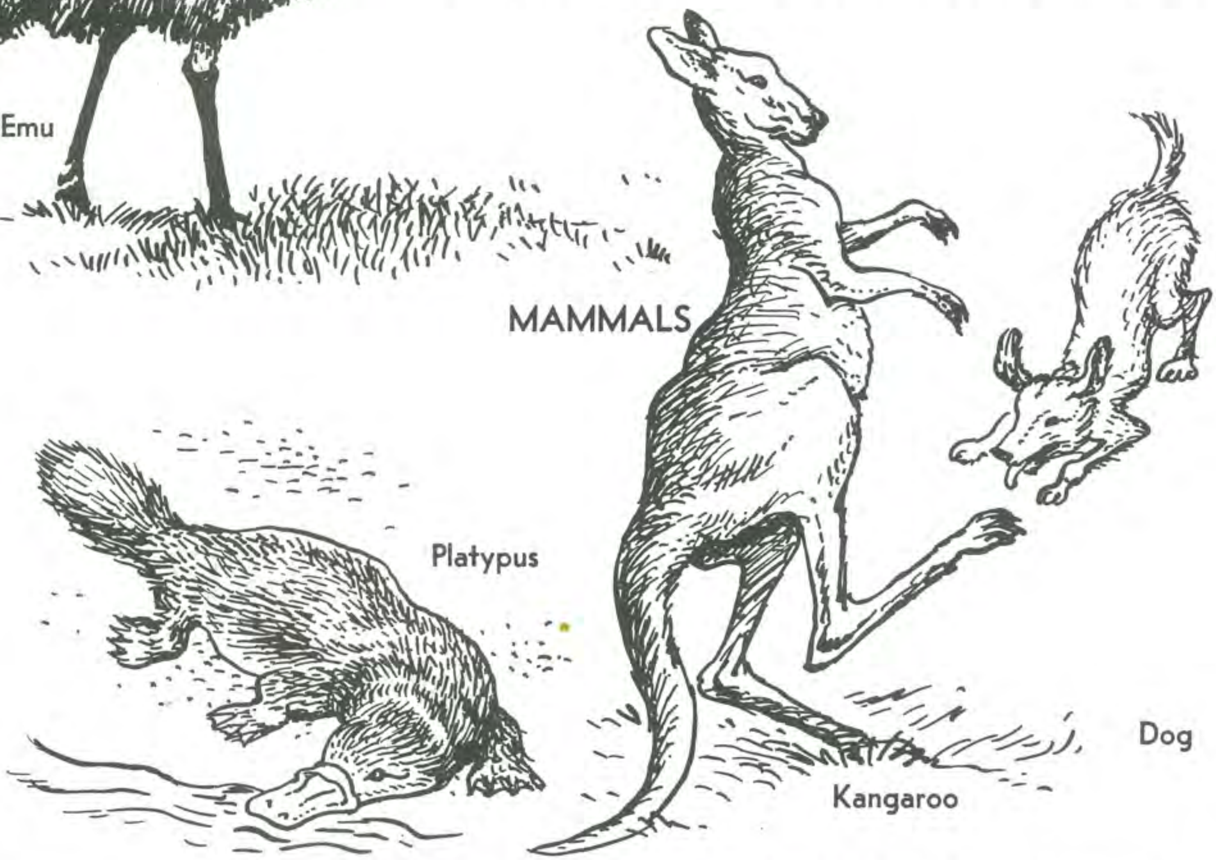
BIRDS



Emu

Birds are animals with feathers. They are very warm blooded. Because they use so much energy, they eat a lot. Not all birds can fly. You should study at least three local birds during the year.

MAMMALS



Platypus

Kangaroo

Dog

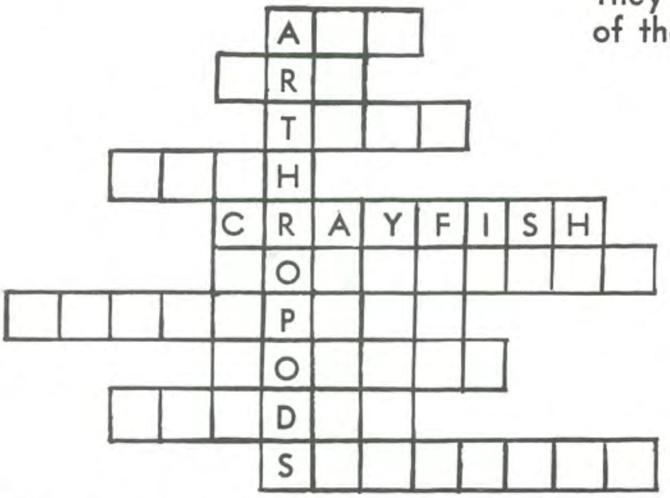
Mammals are animals with hair. They are warm blooded and have lungs. The mother feeds her babies with milk. Australia has two mammals which lay eggs.

They are the platypus and the echidna. Mammals are the highest of the animal kingdom. Man is the highest of the mammals.

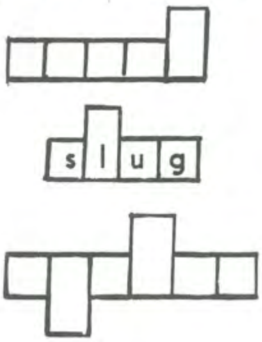
PUZZLE PAGE

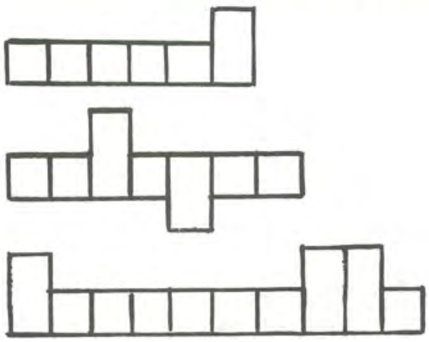
Some of these Arthropods are mentioned on page 51. Can you think of the others?

They are in the list of names at the end of the book.

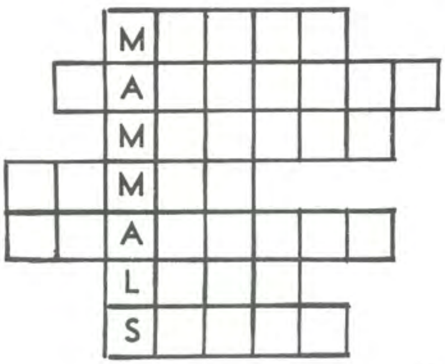


Fill in the patterns with the names of MOLLUSCS. They are all on page 50. One has been done for you.





These MAMMALS are all in the list at the end of the book.



ENERGY

All living things need ENERGY.

They need it in order to grow, move, move other things and to make new living things.

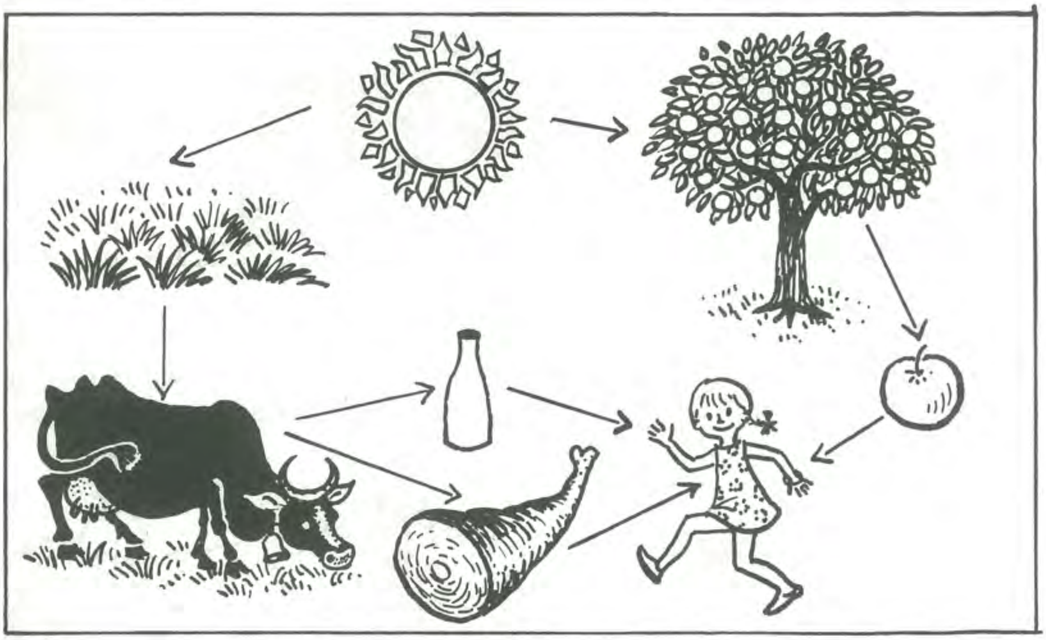
Many animals need energy to keep warm.

Machines need energy in order to move and to move other things.

Most of the energy on the Earth comes from the SUN as HEAT and LIGHT.

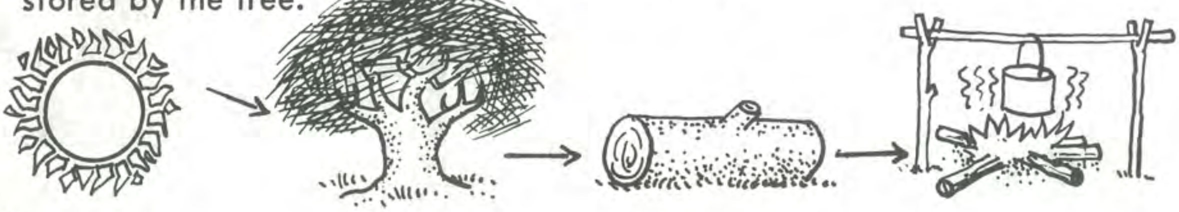
Plants store this energy in the food they make. How do animals obtain energy?

....

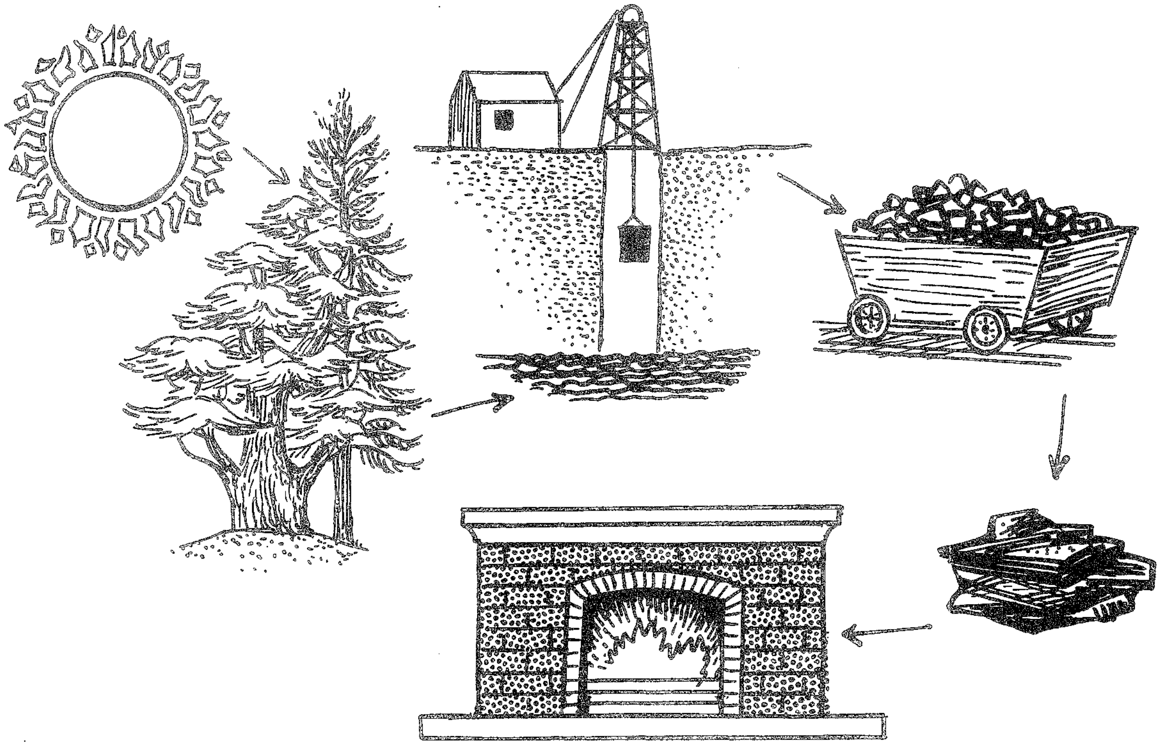


When living things die the energy is not lost. We can still use it.

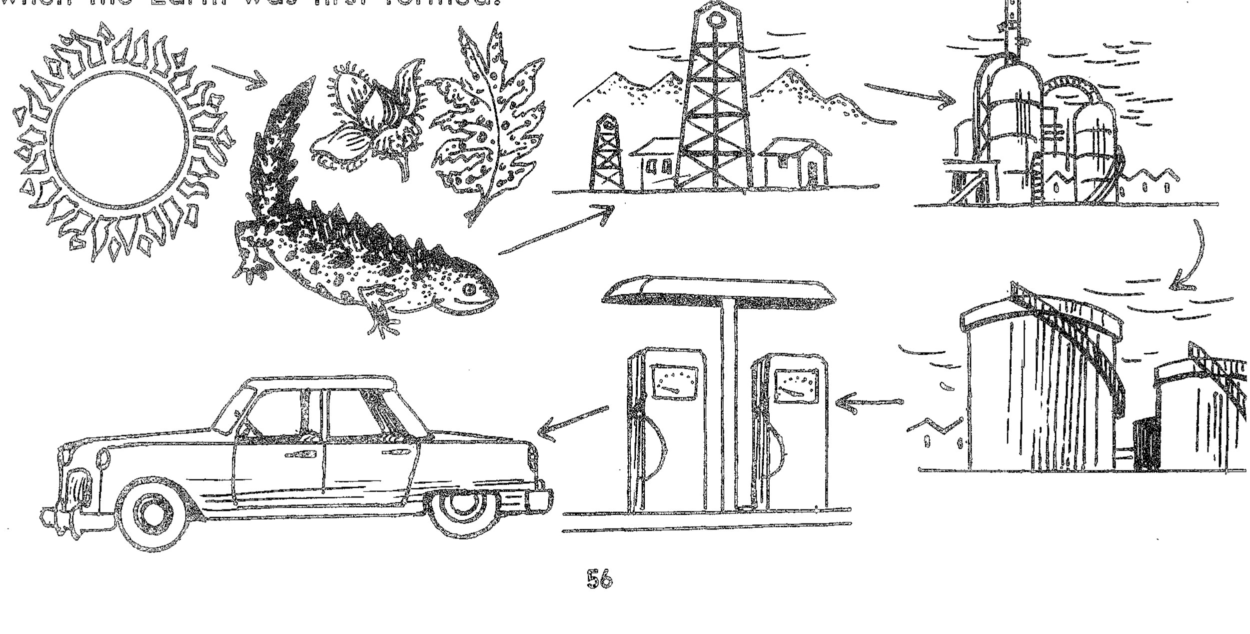
The light and heat we get from a burning log came from the Sun and was stored by the tree.



Heat and light are also stored in COAL. COAL is made from plants which lived millions of years ago. The heat and light came from the sun millions of years ago.



Pétrol and kerosene are other forms of "stored sunlight". They are made from mineral oil. Some scientists believe the oil was formed from plants and animals which lived millions of years ago. Others think the energy was stored in oil when the Earth was first formed.



HEAT FROM RUBBING

Experiment. Rub your hands together briskly. Put them on your cheeks.

They feel ....

Rub a penny on the desk. It soon becomes ....

You have made heat by FRICTION.

That was the way man first made fire. He perhaps knocked two stones together or rubbed two sticks together. The sparks fell on some dry bark or leaves and set them on fire. Some savage peoples still do this.

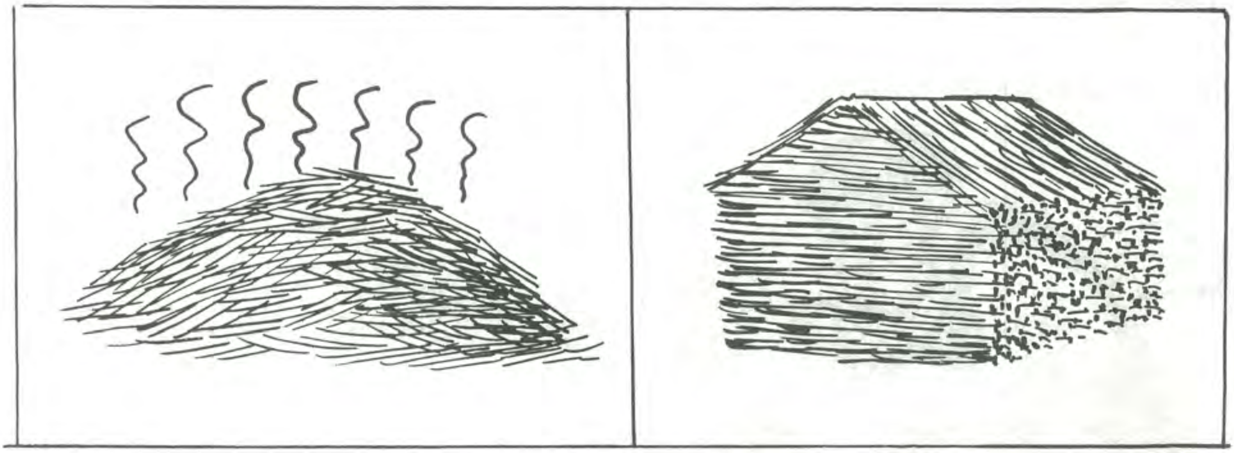
FIRE BY RUBBING

We still make fire by friction, though we can do it more quickly than the man of long ago. We rub a match on the box until the chemicals in the head are hot enough to catch fire. We rub the wheel on the flint until the sparks set fire to the petrol vapour. We still use energy to make heat. Food provides the energy to do the rubbing.

HEAT FROM DECAY

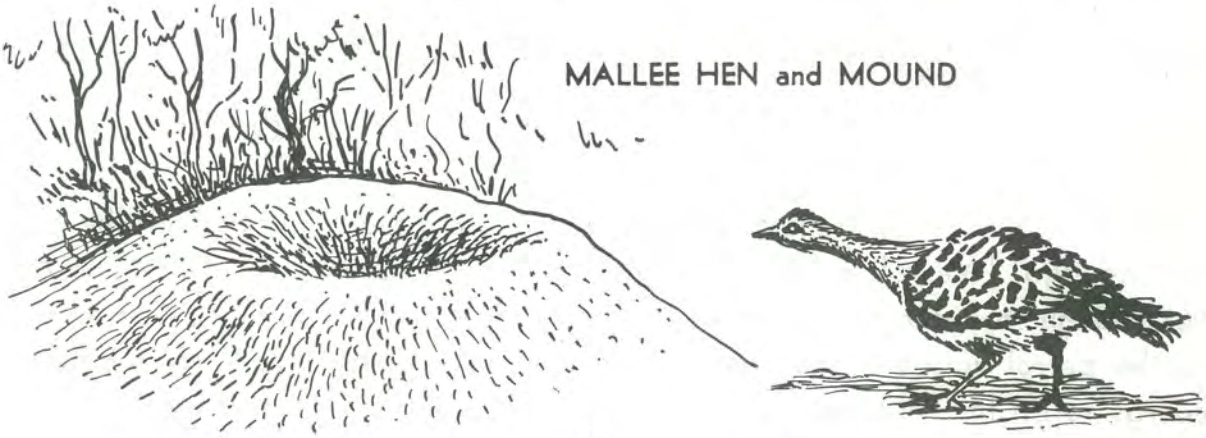
Usually we think that wet things will not burn. Have you ever felt the inside of a pile of grass clippings which have been left for some time? How did it feel? ....

The grass was decaying and it gave out heat. This is called slow burning or slow combustion. Sometimes a pile can become so hot that it catches fire. This may happen to a hay-stack if the hay was not quite dry when the stack was made. The same thing can happen to a cargo of wheat.



SLOW COMBUSTION

The Mallee Fowl uses slow combustion to hatch its eggs. It builds a very large mound of leaves, grass, sticks and earth and buries its eggs in the mound.



MALLEE HEN and MOUND

"FIRE IS A BAD MASTER"

"Fire is a good servant but a bad master."

Long ago men found what a good servant fire could be. Fire gave them light in their caves, kept them warm, cooked their food and kept away wild animals.

They also knew how it could be a bad master when it swept through the forests.

In Australia fire has been a bad master. Thousands of acres of bush have been destroyed by fire. Our animals, our birds, our trees and our beautiful native plants have been destroyed. Farms, villages and towns have been burnt out and many people have died in bush fires.

Many of these bush fires have been caused by neglected camp or picnic fires.

Always clear a wide area round your fire.

Always see the fire is out before you leave. Cover the ashes with a thick layer of soil. Fires cannot burn without air.

Never make a fire next to a tree. Draw what might happen.

THE EVENING STAR

If you look in the Western sky not long after sunset you will often see a very bright "star". It is brighter than anything in the night sky except the moon. It is not a star but a planet like the earth.

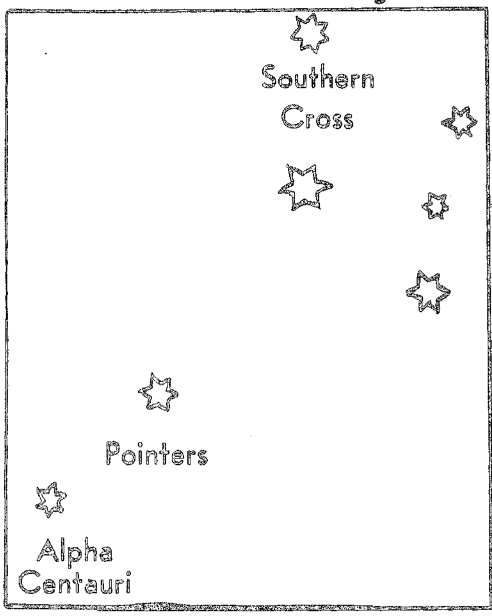
Its name is VENUS. Many people call it the "Evening Star". It can sometimes be seen before sunrise in the Eastern sky. It is then called the "Morning Star".

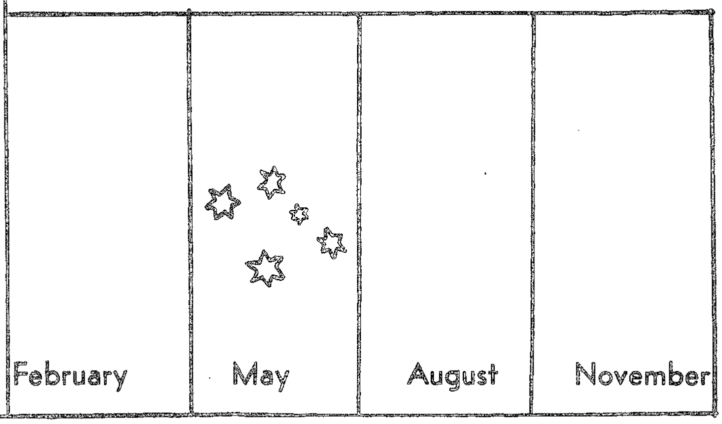
Venus travels round the Sun like the Earth but it is closer to the Sun. It shines so brightly because there are clouds all round it and they reflect the light of the Sun. Try to find Venus.

THE SOUTHERN CROSS

Stars are blazing masses of gas. Nothing could live within millions of miles of a star. Our nearest star is the sun which is a very small star. There are hundreds of millions of stars in the sky. Groups of stars are often given names.

One of the easiest groups to find is the SOUTHERN CROSS. It is made of five stars. The two bright stars on the left are the POINTERS. One of them, Alpha Centauri, is the closest star except the Sun to the Earth. The Southern Cross changes its position. I have drawn it as it looks in May. You draw it as it looks at other months.





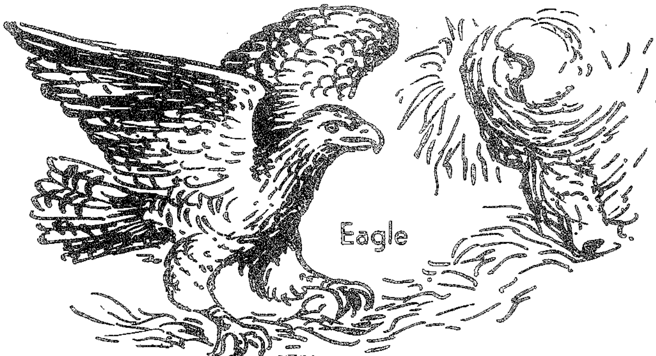
HOW ANIMALS LEARN ABOUT THE WORLD

We learn about the world through our five senses: sight, hearing, taste, touch and smell.

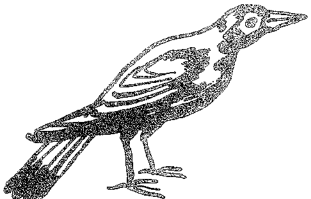
Most higher animals learn in the same way, though some of them have better senses than we have.

Birds have better sight. An eagle can see a small animal from a great height.

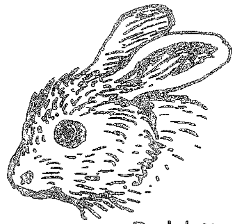
Birds can hear well. A magpie can hear a grub or a worm moving underground.



Eagle

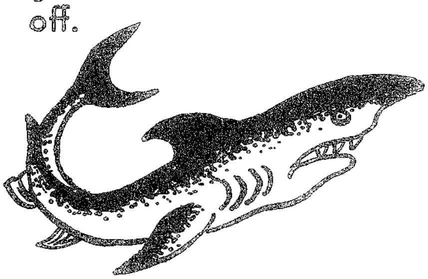


Magpie

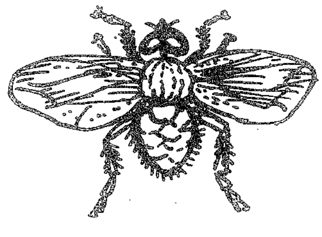


Rabbit

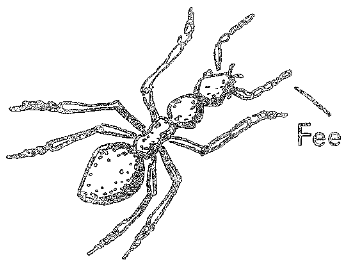
Many mammals have very good hearing. Some of them, including dogs and rabbits, can move their ears. You have probably seen your dog "prick" its ears at a faint sound. Many mammals have a very good sense of smell. Bloodhounds can follow the scent of a person for miles. Insects can smell food from great distances. Fish can smell well. Sharks can smell blood from a great way off.



Shark



House-fly



Feelers

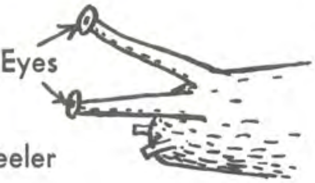
Most insects have very large eyes. Sometimes they are made up of many parts. These are called compound eyes. Insects and crustaceans [crabs, etc] have feelers. These are probably not only used for touch but also for smell and hearing. Perhaps you have watched a cockroach moving its feelers round as if it were smelling or listening.

Some insects have their ears in strange places. The cricket has its ears on its front legs.

Snails have their eyes on hollow stalks and can pull them down inside the stalks.

Snakes cannot close their eyes as they have no eyelids.

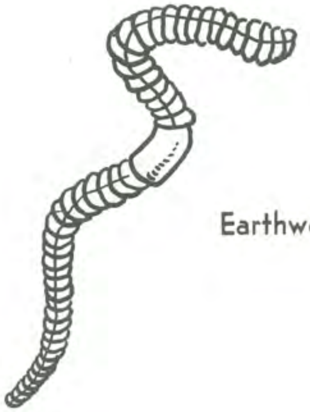
Cricket's Front Leg



Snail's Head

Snake's Head

The earth worm has no eyes, ears or nose but it can smell and taste. It can sense movement and has a sense of touch. If you touch one it will often wriggle quite violently. It can sense light. If you shine a torch on one in the dark it will usually try to get out of the light. Sea anemones have a sense of touch. They will close up if you touch them.



Earthworm

Open

Sea Anemone

Closed

Study as many animals as you can and try to find out how they learn about the world around them.

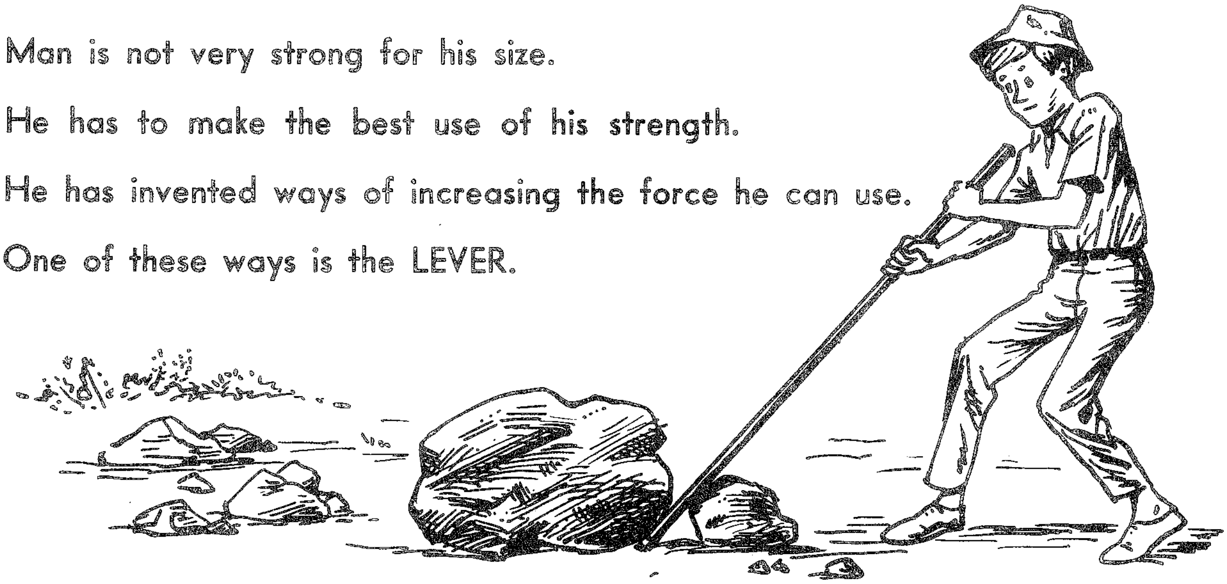
MAKING BETTER USE OF FORCE

Man is not very strong for his size.

He has to make the best use of his strength.

He has invented ways of increasing the force he can use.

One of these ways is the LEVER.



Have you lifted a big stone by using a crowbar or a long stick and another stone. If so, you have used a lever. If you have not, try it.

Try with different length sticks.

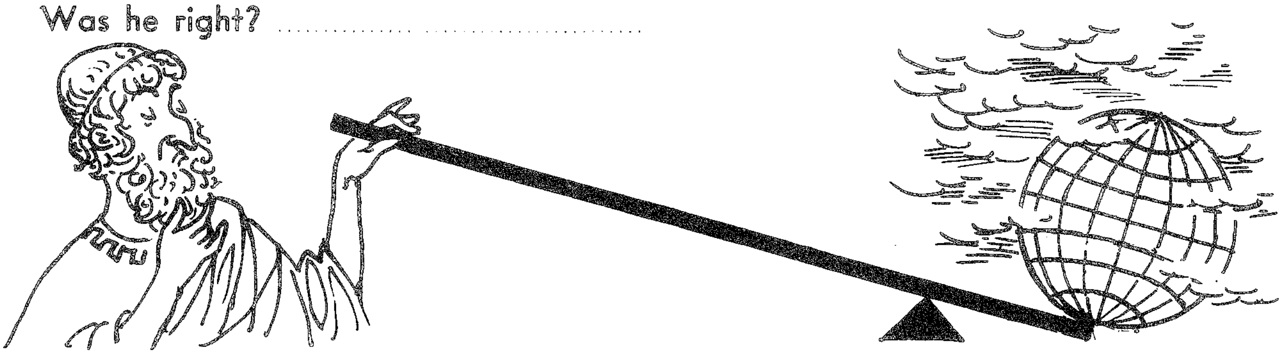
What do you find? The longer the stick the [easier, harder] it is to lift the big stone.

Place the smaller stone in different places.

The closer it is to the big stone the [easier, harder] it is to lift the big stone.

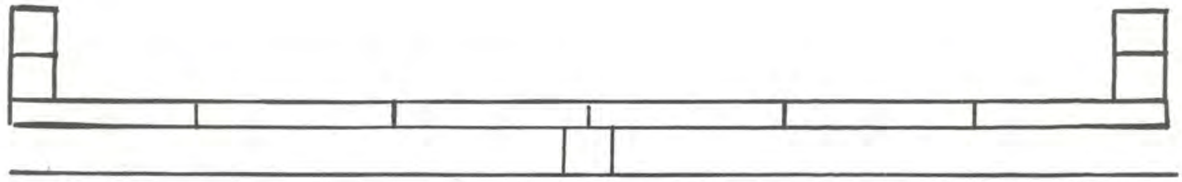
A Greek scientist named Archimedes said 2000 years ago, "If I could find a long enough lever, something to rest it on and somewhere to stand I could lift the Earth."

Was he right? ....



Some Experiments with Levers. You will need a flat strip of wood 3' long and some small wood blocks all the same size. Mark the board with lines 6" apart.

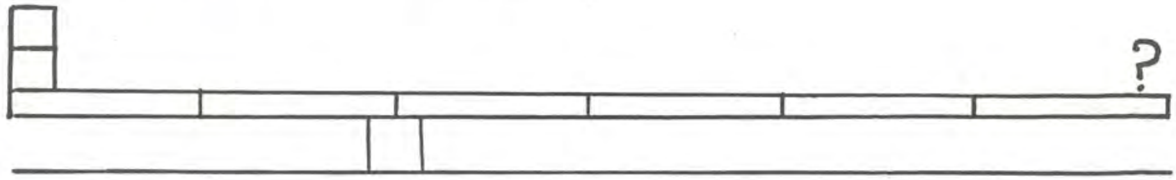
Balance the strip on one block in the middle.



Place 2 blocks at one end. How many blocks are needed at the other end to balance? ....

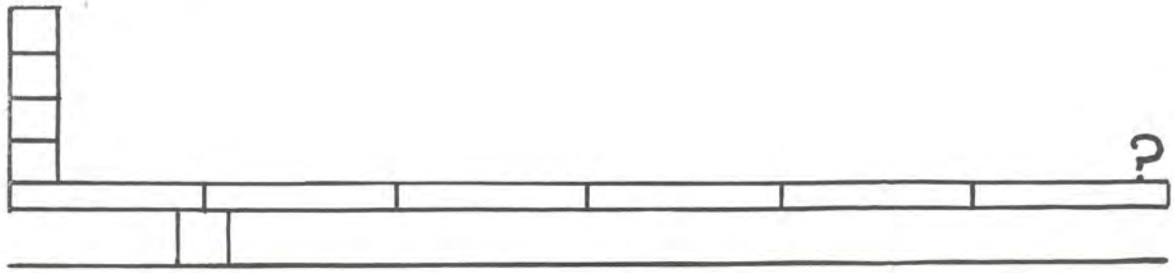
Now place the block under the second mark on the strip.

Place two blocks on the short end.



How many blocks are needed on the other end to balance? ....

One block will balance two but it is twice as far from the balancing point. Now place the balancing block under the first mark. Place five blocks on the short end.



How many blocks are needed to balance? ....

One block will balance five but it is five times as far from the balancing point.

The further the blocks are from the balancing point, the greater the force they have.

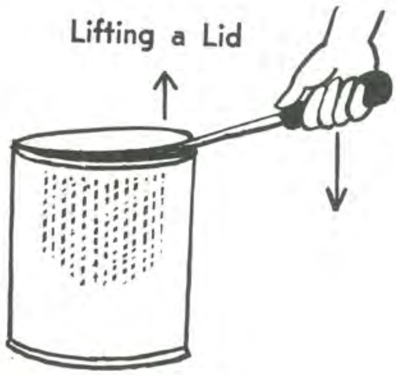
The balancing point is called the FULCRUM. When you lifted the stone the little stone was the fulcrum. You could lift the stone because you were further from the fulcrum than the stone so you made better use of the force.

Some Other Levers.

In these drawings put F for the force used and W for the weight moved.

Raising a Stone

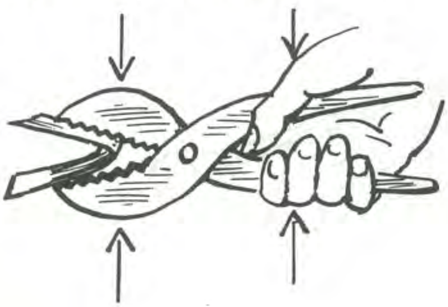
Lifting a Lid



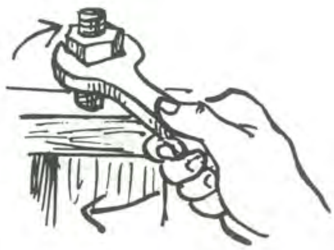
Pulling a Nail

Lifting a Barrow-load

Squeezing a Piece of Metal



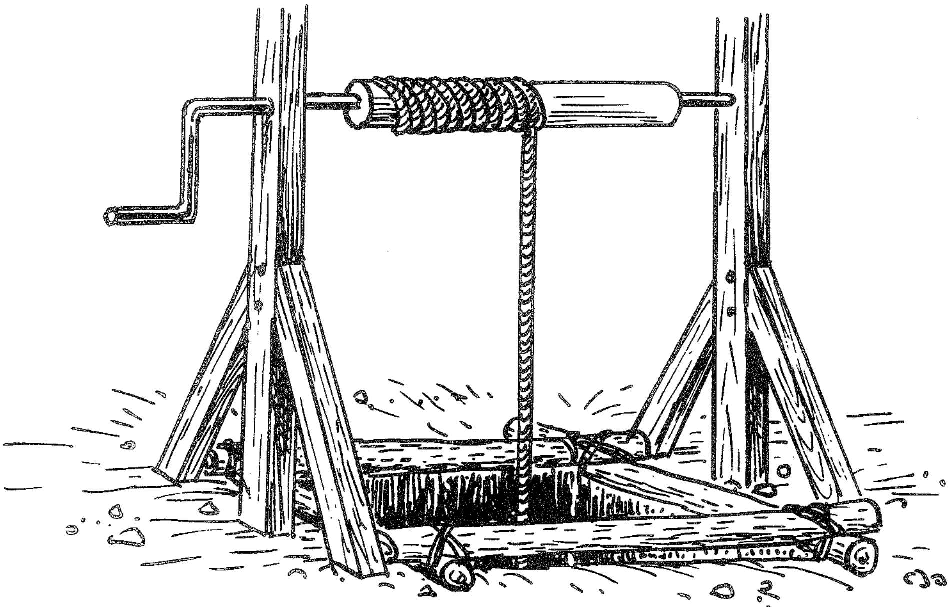
Turning a Nut



THE WINDLASS

Another machine that man invented to make better use of his strength is the windlass or winch. In some places it is used to raise water from a well.

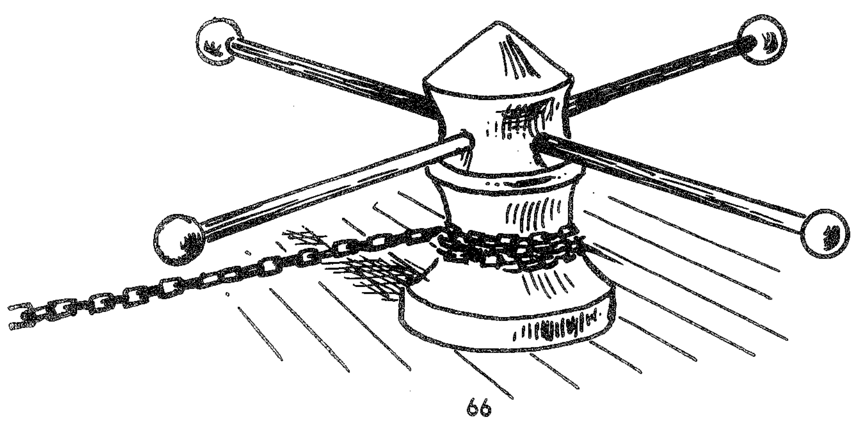
The gold miners used it to raise dirt from their mine shafts. It is a roller with a rope wound round it by turning a handle.



THE CAPSTAN

If a winch is turned sideways it is a capstan. The sailors used them on sailing ships to raise the anchor.

They often sang shanties while pushing round the capstan to raise the anchor.

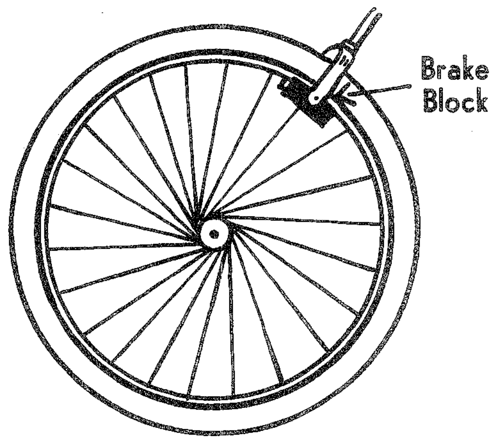


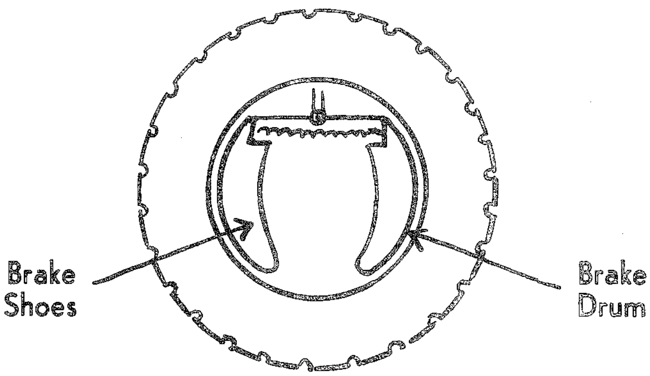
RUBBING FORCE

How do you slow down the car or your bicycle? You put on the .... Brakes slow the moving wheel by using a rubbing force. This is the force of FRICTION.

You can see the little blocks which rub on the rim of your bicycle.

Car brakes are inside drums on the wheel.





Experiment. Turn your bicycle up-side down and spin one wheel. Slow it down by holding a piece of wood on the tyre. You are retarding the movement of the wheel by friction. What difference does it make if you press lightly or heavily?

....

....

There is always friction when one thing moves on another.

Friction always tries to stop things moving.

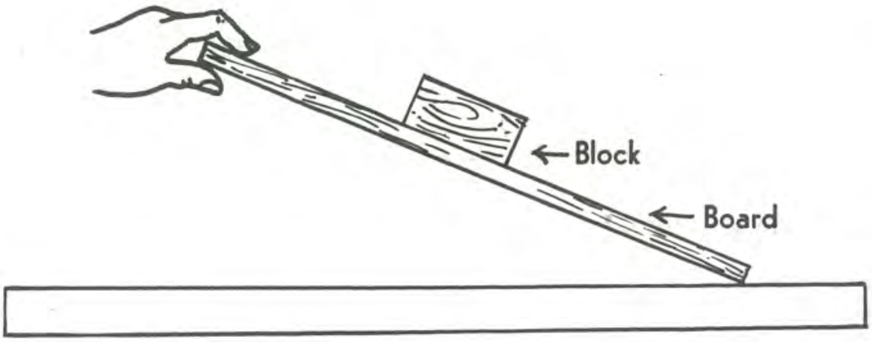
Friction is a [retarding, accelerating] force.

Some experiments with friction.

You need a block of 4" x 2" hardwood about 8" long, a board 2' long and 6" wide, a sheet of glass, a sheet of rough glass-paper, some oil or grease.

Smooth one 4" side and one 2" side of the block. Leave the other sides rough.

Lay the board on a table and rest the block on it. Lift one end of the board until the block just moves. The amount you have to lift the board will show how much friction there is.



Experiment.

1. Place block with 4" rough side down.
2. Place block with 4" smooth side down.

   There is [more, less] friction than in 1. ....
3. Place block with 2" rough side down.

   There is [more, less] friction than in 1. ....
4. Place block with 2" smooth side down.

   There is [more, less] friction than in 1. ....
5. Place the sheet of glass on the board. Place the block with 4" rough side down on the glass. Allow the block to slide on the glass.

   There is [more, less] friction than in 1. ....
6. Use glass-paper instead of glass.

   There is [more, less] friction than in 1. ....
7. Oil or grease the board and the rough 4" side of the block.

   There is [more, less] friction than in 1. ....

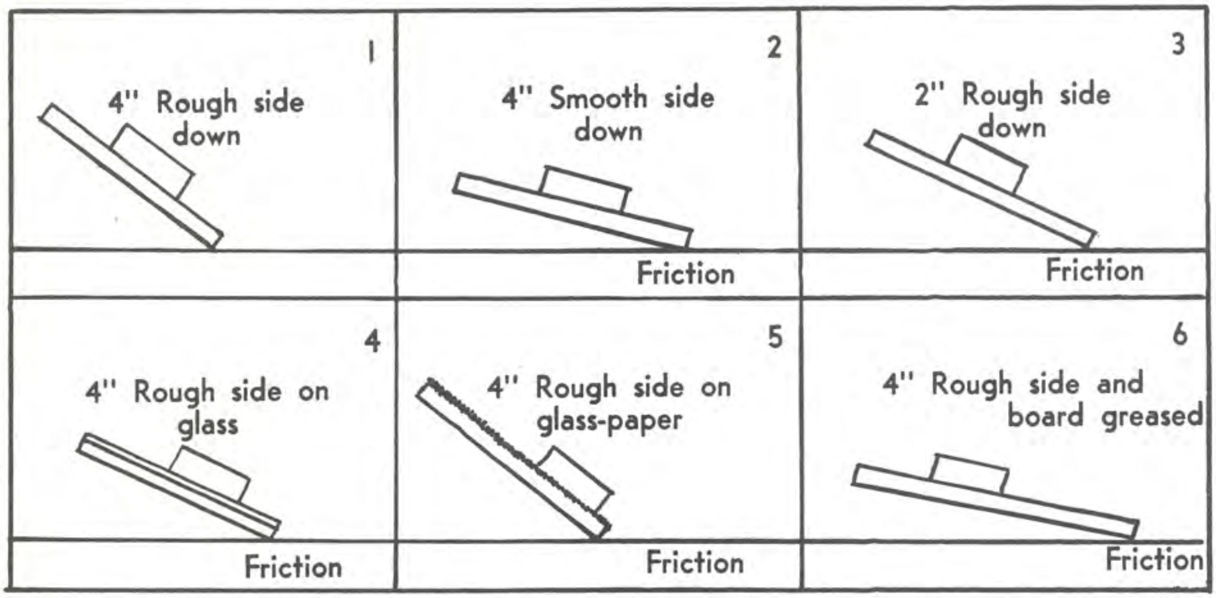
Now answer these:

1. The smaller the surface touching the [smaller, greater] the friction.

   ....
2. The smoother the surface touching the [smaller, greater] the friction.

   ....

Write "More" or "Less" in pictures 2 to 6.



REDUCING FRICTION

Because friction makes things hard to move we usually do not want friction in machinery.

There is less friction with smooth surfaces, so moving parts in machines are often very smooth.

Name some smooth moving parts in your bicycle or the car or the lawn mower or the sewing machine.

....

....

Why does rust make things hard to move? ....

....

Grease or oil makes things smoother so we use them to reduce friction.

How often do you oil your bicycle? ....

Which parts do you oil? ....

How often is your car greased? ....

Name some parts which are greased? ....

....

Why is Dad careful to see that there is plenty of oil in the car sump? ....

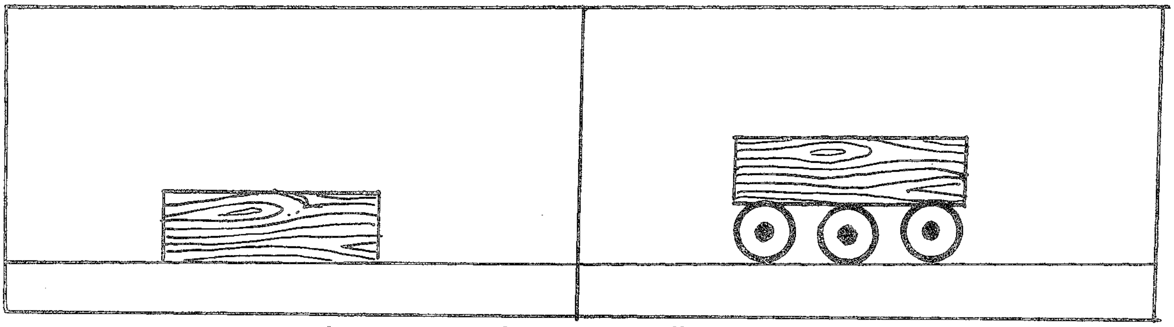
....

Why is a dance floor waxed? ....

There is less friction with round things than flat ones. Why? ....

....

Experiment. Push a block of wood along a flat table. Now rest it on 3 or 4 pencils and push it. Which is easier to push? ....



It is easier to move a house or a boat on rollers.

Wheels are even better than rollers. Why? ....

....

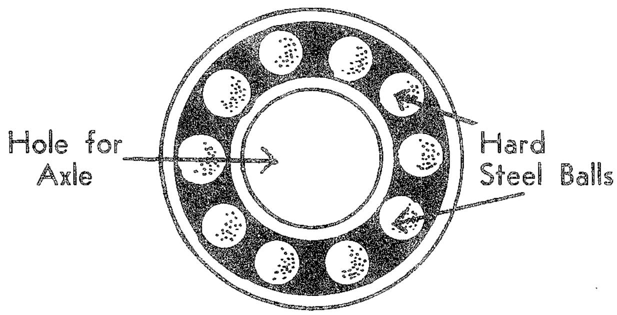
Name some things that move on wheels. ....

....

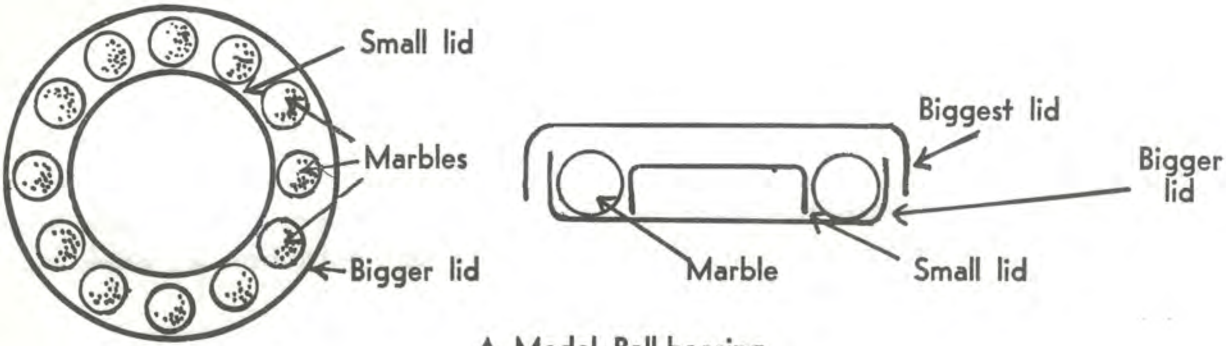
Many wheels have ball-bearings in the centre to make them move more easily.

Your bicycle wheel has them.

A ball-bearing looks something like this.



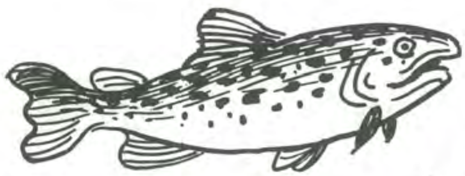
You can make a model of a ball-bearing. You need some marbles, a small tin lid, one about 1" bigger across and a third slightly bigger still. Place the small tin in the centre of the second tin. Place marbles round it. Cover these two lids with the third one. Place a book or a box on the lid. It should spin easily.



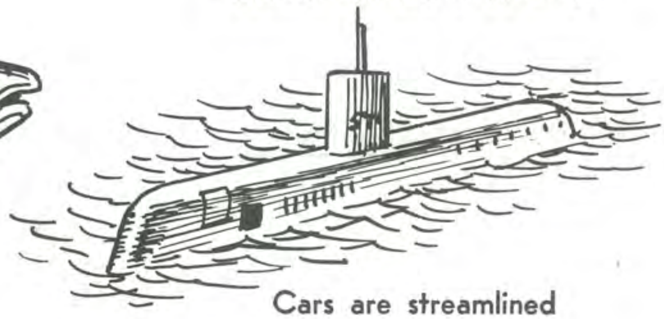
A Model Ball-bearing

When things move through the air or through water there is friction. If they want to move quickly they must be smooth and they must be the right shape. The right shaping is called STREAMLINING.

Fish are streamlined

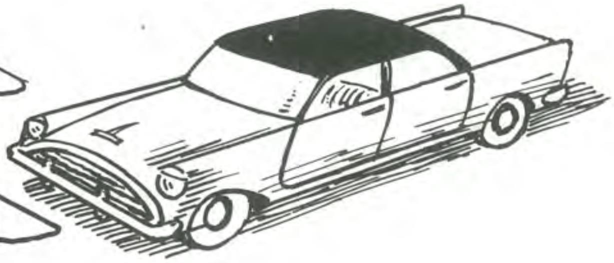


Submarines are streamlined



Planes are streamlined

Cars are streamlined



Friction causes heat. If you have touched a moving wheel with your finger you will know this. When satellites speed through the air they become very hot.

USING FRICTION

Though we often try to get rid of friction we would find it difficult to live without it.

There is always some friction even on a very slippery floor. You know how difficult it is to walk on a slippery floor. If there was no friction we could not walk at all.

Some questions.

1. Why is it hard to catch a greasy pig?

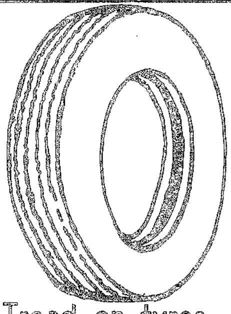
2. Why is it dangerous to have smooth tyres on a car?

3. Why is it difficult to write on greasy paper?

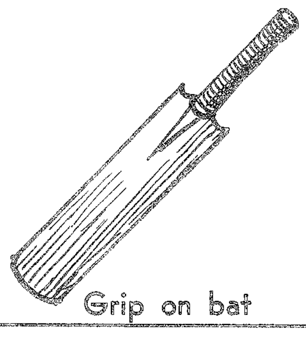
4. What keeps nails and screws from pulling out of wood?

5. Why do you put branches or a sack under the wheel when the car is bogged?

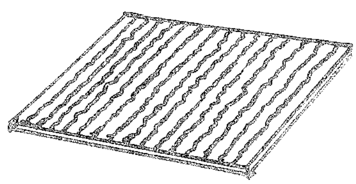
We often try to increase friction to prevent slipping.



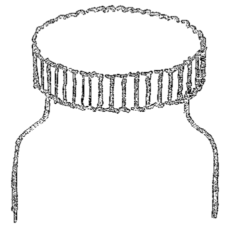
Tread on tyres



Grip on bat



Ridges on mat



Ridges on screw-cap

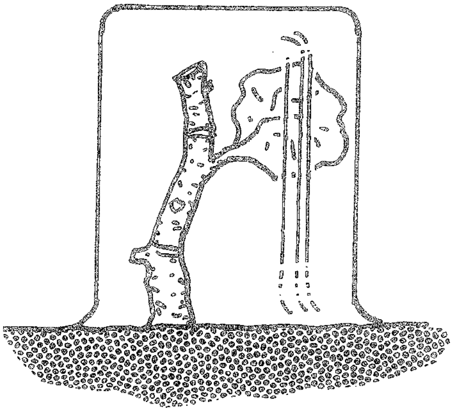
Add two of your own.

GROWING PLANTS WITHOUT SEEDS

Most plants grow from seeds, but it is possible to grow some plants from other parts of the plant. Plants can be grown from stems, roots, buds and leaves. You might try growing some plants in these ways.

STEMS.

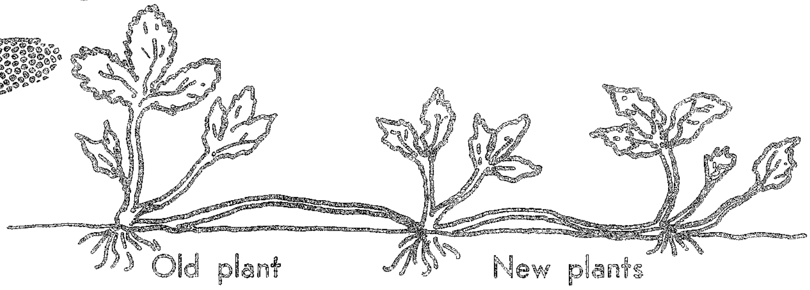
Cut a piece of geranium stem about 6" long. Cut just below a leaf joint. Plant the cutting in moist sand and cover it with a glass jar.



Geranium "cutting"

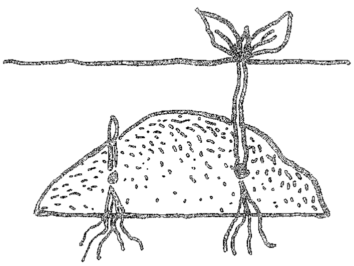
Many plants will grow from cuttings. Some do better if you stand the cutting in a jar of water until the roots grow. Willow does.

Strawberries grow from stems which run along the ground.

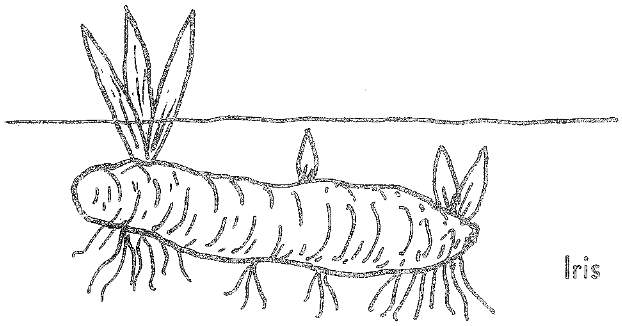


A potato is an underground stem. The "eyes" are buds. Cut off a piece of potato with two or three "eyes" and plant it. It will grow into a potato plant.

The iris has an underground stem which grows into a new plant.

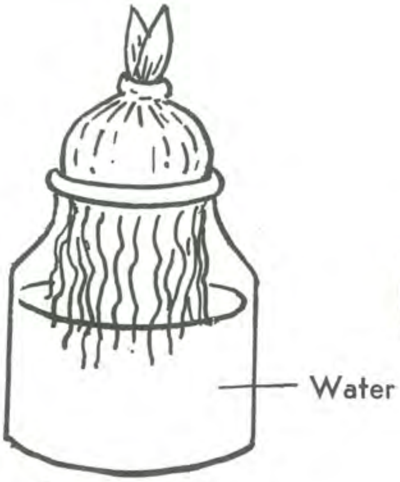


Potato growing



Iris

BULBS and CORMS are also stems. An onion is an easy bulb to grow. You can grow it over water as shown in the drawing.



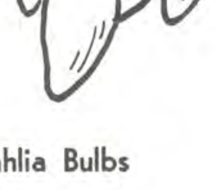
Growing Onion

Gladiolus Corm

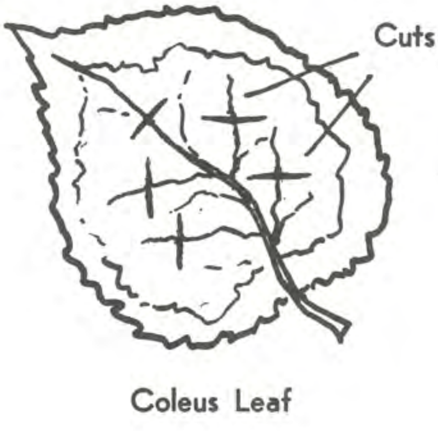
Growing Carrot-top

ROOTS. To grow a plant from a root, pick a large root. A carrot, beetroot, parsnip or turnip will do. Cut about $1\frac{1}{2}$ inches off the top and place the cut side down in a saucer of water.

A dahlia "bulb" is really a food storing root.



Dahlia Bulbs



Coleus Leaf

Coleus plants and begonias can be grown from leaves. Take a thick strong leaf and make light cuts across the leaf veins on the underside. Press the leaf down on moist sand. Do not bury it. Keep the leaf moist and warm.

HOW WE SEE THINGS

Some questions to think about and talk about.

How do we see things? ....

Why cannot we see things if our eyes are shut? ....

Can we or any animal see things if there is no light at all? ....

We see a thing because light comes from that thing and enters our eyes.

Some things give out light themselves. They are LUMINOUS. The SUN is the most luminous thing we can see. It gives us most of the light we have on Earth.

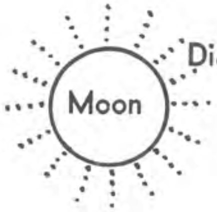
Underline the luminous things:

A star, the moon, a mirror, a bonfire, lightning, a cycle-reflector, a window, a hydrogen bomb, a neon sign, a glow worm, a glowing radiator, "cats' eyes", a diamond, a luminous watch face, water, an animal's eyes at night, a polished floor.

Most things are NON-LUMINOUS. We see them because they send back, or REFLECT, light from luminous things.

We see things in the day light because they reflect light from the Sun.
The Moon reflects light from the Sun.

Star 



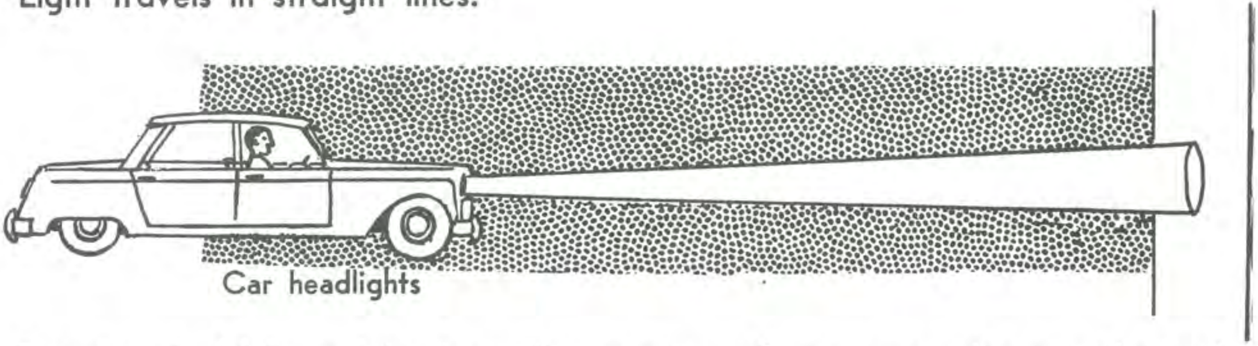
Diamond 

LUMINOUS | NON-LUMINOUS

Draw and name more things.

PATHS OF LIGHT

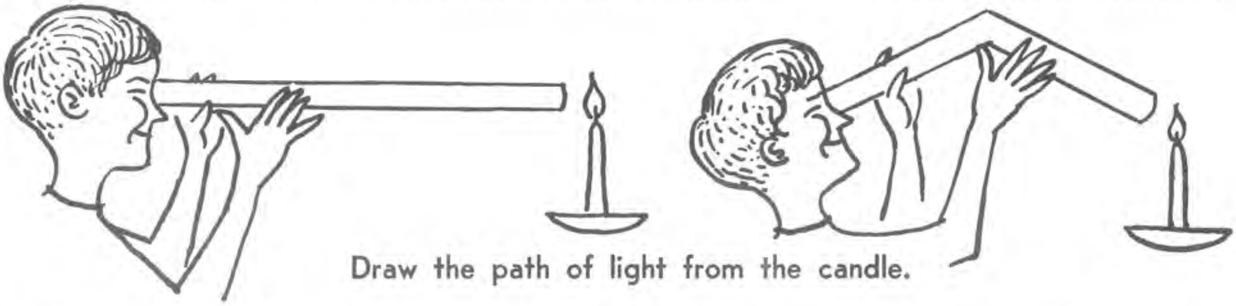
Light travels in straight lines.



Experiment. Make a tube by rolling a piece of paper round a pencil. Look at a light through it with one eye. Now bend the tube and look.

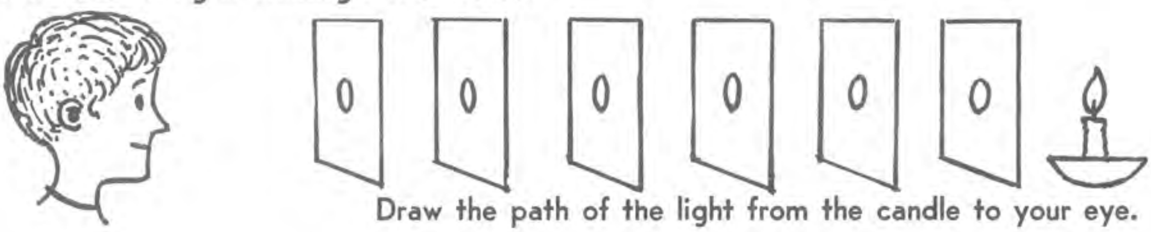
Can you see the light? ....

Why not? ....



Draw the path of light from the candle.

Experiment. Punch a hole exactly in the middle of 6 cards the same size. Fasten each to a small block so it will stand up. Place them in line so that you can see a light through the holes.



Draw the path of the light from the candle to your eye.

What happens if you move one card? ....

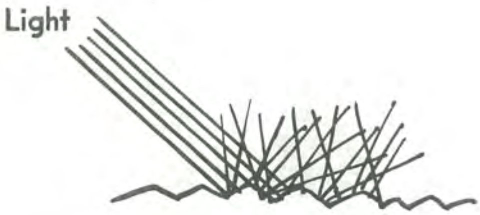
....

What does this prove? ....

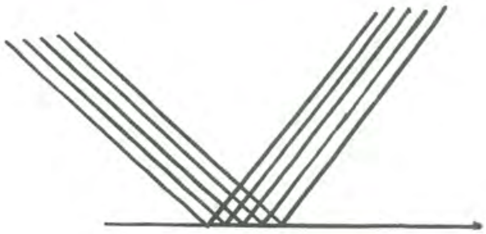
MAKING LIGHT BEND BACK

All things reflect light.

Rough surfaces scatter the light. Smooth surfaces reflect the light without scattering it.



Rough surface scatters light.



Smooth surface does not scatter light.

The smoother the surface the better the reflection.

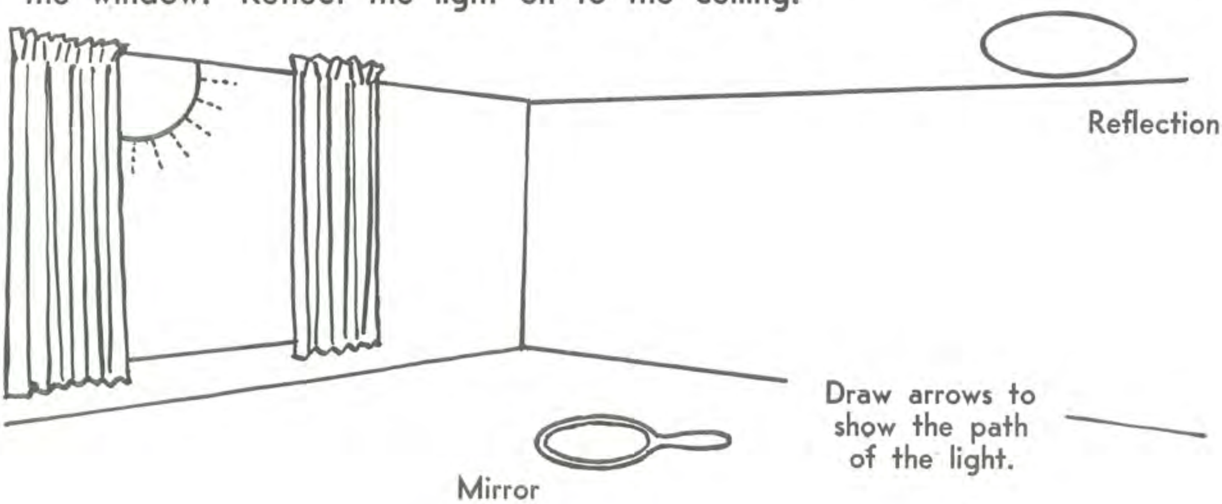
Which reflects better

(a) A dry dusty road or a wet bitumen road? ....

(b) A still pool or a running creek? ....

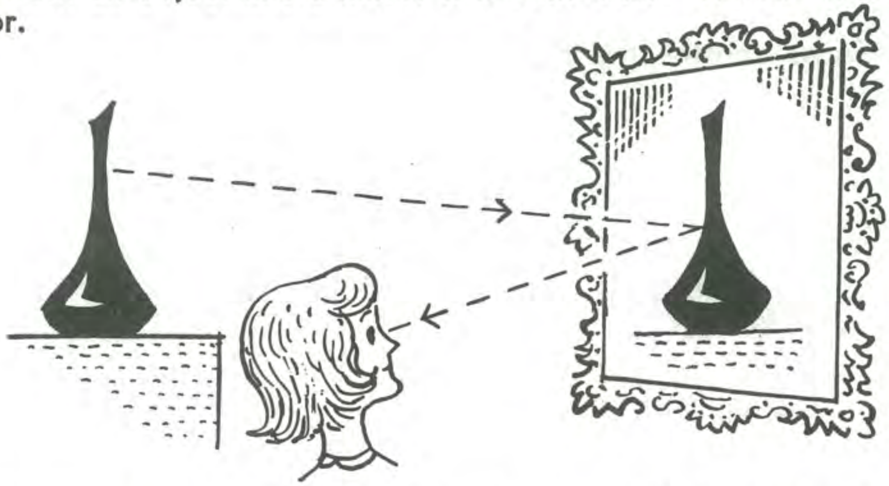
(c) A new tin or a rusty tin? ....

Experiment. Hold a mirror or a shiny tin lid in the sunlight coming through the window. Reflect the light on to the ceiling.



SEEING THINGS IN A MIRROR

When light from an object hits a mirror it is bent back. We see a "reflection" in the mirror.



The reflection is called an image. Is the image really "in" the mirror?

....

Experiment. Stand in front of a mirror. Raise your right hand.

Which hand does the image raise? ....

Cover your left eye.

Which eye does the image cover? ....

Write ENCYCLOPAEDIA on a card. Can you read it in the mirror? ....

What happens to it? ....

Can you read this? THIS IS AN IMAGE

Hold it up to a mirror.

Can you read it now? ....

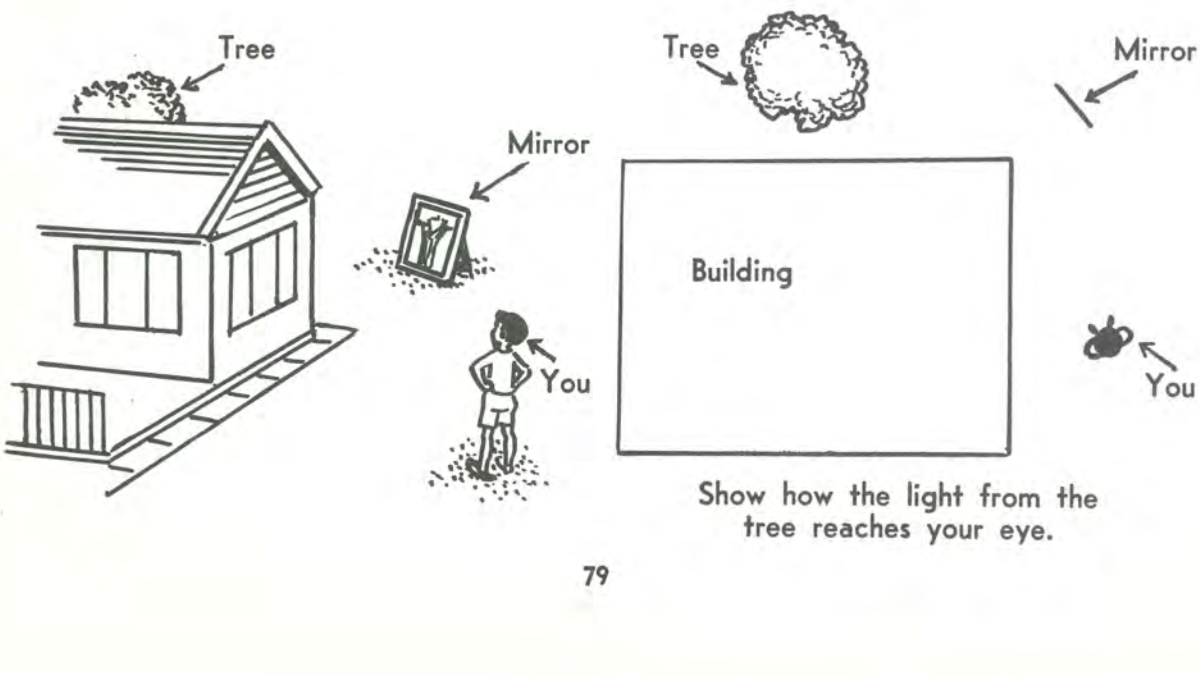
What does the mirror do to an image? ....

Experiment. Stand with your mate in front of a big mirror so you can both see your own image and each other's image. Move apart so that you can not see your own image but can see each other's image.

Draw arrows to show how you can see each other's image.

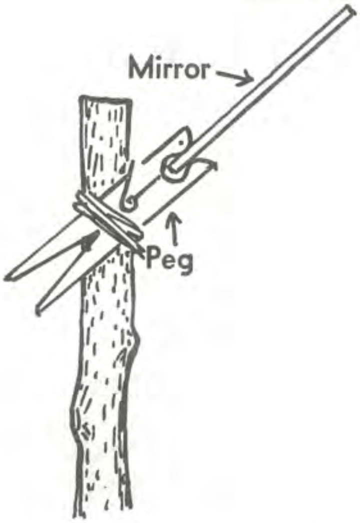
Because light travels in straight lines we usually cannot see round corners.

We can bend light round corners by using a mirror. By placing a mirror you can see the tree round the corner of the building.



Show how the light from the tree reaches your eye.

SEEING ROUND CORNERS AND OVER WALLS

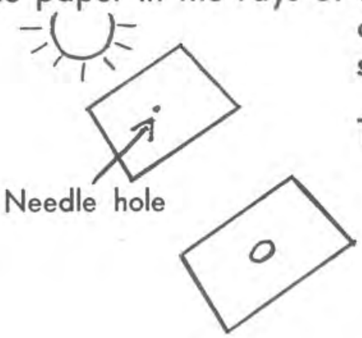


Fasten a spring clothes-peg to a long stick at an angle of 45°. Clip a small mirror into the peg.

By using two mirrors you can make a periscope. You can find instructions in several books.

IMAGES WITH PIN HOLES

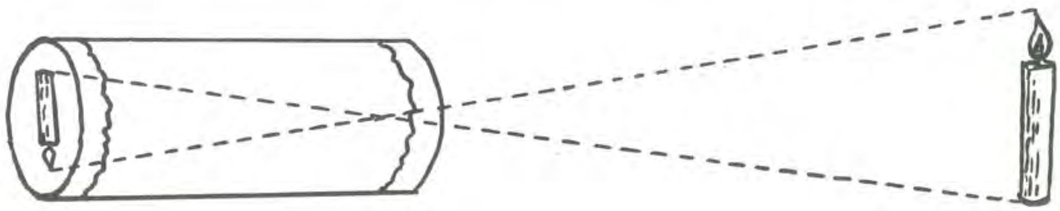
Experiment. Make a hole with a sharp needle in a sheet of paper. Hold the paper in the rays of the sun over a sheet of white paper. Move the sheets closer or further apart until you get an image of the sun.



This is the only safe way to watch an eclipse.

A PIN-HOLE CAMERA

Paste brown paper over one end of a short cardboard tube and grease-proof paper over the other. Make sure both papers are tight. Make a small, clean hole in the brown paper. Make an image of a candle in a darkened room.



What do you notice about the image? ....

WHAT IS THE SOIL IN YOUR DISTRICT LIKE?

SOIL is made of broken-up rock and decayed plant and animal remains.

Soils may be black, red, yellow, grey and some are almost white. The colour depends a good deal on the colour of the rocks from which it was made.

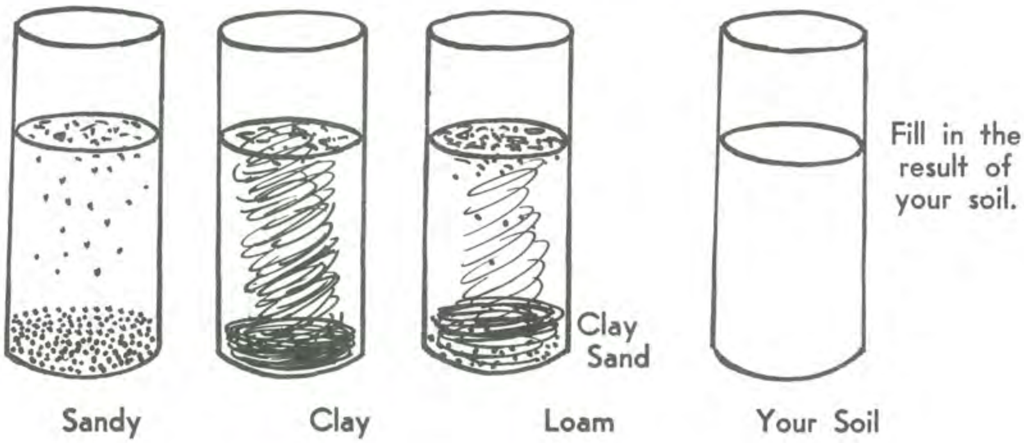
What colour is the soil in your district? ....

What colour are the rocks? ....

Black soils often contain a good deal of humus [plant and animal remains].

Some soil is very sandy. The soil round Sydney is sandy. Some soil is very heavy. It is mainly clay. Have you heard of the Black Soil Plains? Soil half-way between clay soil and sandy soil is called loam. What kind of soil is in your district? ....

Experiment. Stir up some soil in water in a tall jar. Let it settle. Sandy soils settle quickly. Clay soils settle slowly. The water stays muddy for a long time. In loamy soil the sand settles first and the clay later.



Something floats on top of the water. What is it? ....

The soil in your district may not have been made there at all. It may have been carried there from a great distance.

If you live on river flats the soil was probably carried there by the river.

If there are river flats near you look at the soil. Is it the same as other soil in the district? ....

Some soil has been carried by wind. This is called LOESS.

Clay was often brought by glaciers. Some soil was formed from ash blown out of volcanoes.

Some scientists believe that soil has more often been brought from another place than made from the rocks at the place.

SOIL AND WATER

Plants take water in by their roots. Soil must hold some water. Different soils hold different amounts of water. You can show this.

Experiment. You need three funnels, three bottles the same size, three pieces of blotting paper 3" square, dry sand, clay, garden soil [loam]. Fold the blotting paper as shown. Place one piece in each funnel. Half fill one funnel with sand, one with powdered clay, one with soil. Place each funnel in a bottle. Pour the same amount of water in each funnel.

Show levels of water in each bottle.

Which soil lets water through quickest? ....

Which soil lets water through slowest? ....

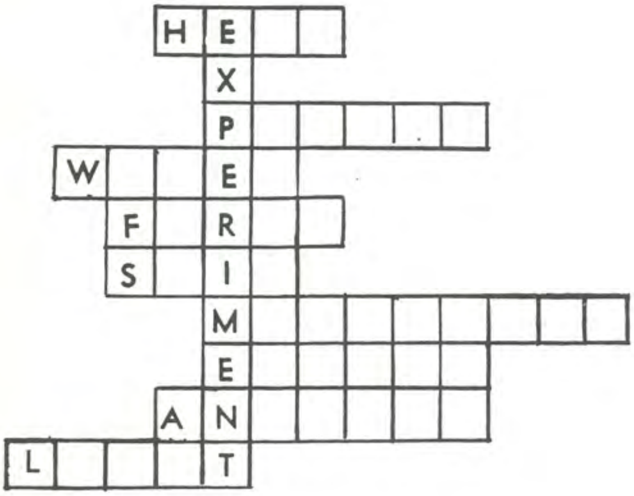
Which soil holds most water? ....

Which soil holds least water? ....

Clay usually holds too much water. Sand holds too little. Loam is best for plants.

PUZZLE PAGE

We do experiments to find out about the world we live in. Fill in some of the things we learn about through experiments.



Fill in the right words in these patterns:

Movement up and down.

Burning.

Rubbing force.

Water changing into vapour.

Vapour changing into water.

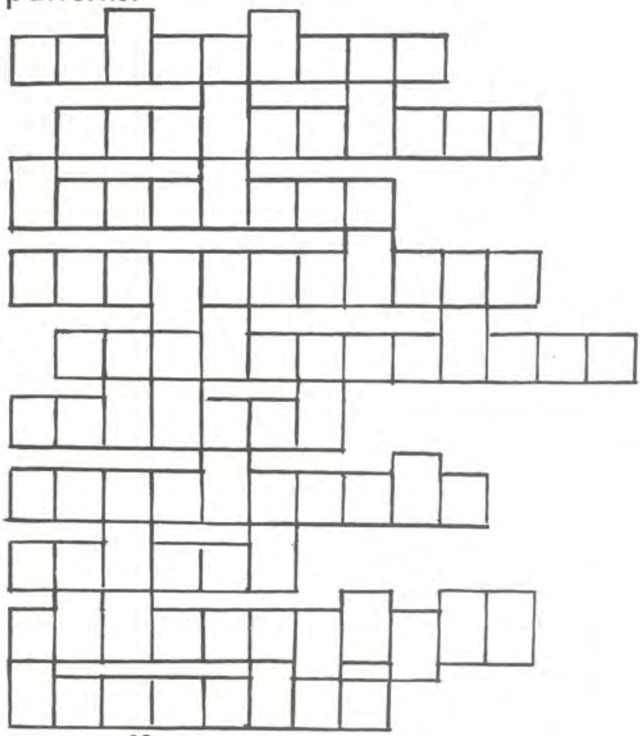
To bend light.

To make things move faster.

To make things move slower.

Green in leaves.

To disappear into water.



WEATHER RECORDS

Keep records of temperature and wind direction and strengths.

	MARCH			JUNE			AUGUST			NOVEMBER		
Date	T°F	W.D.	W.S.	T°F	W.D.	W.S.	T°F	W.D.	W.S.	T°F	W.D.	W.S.
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

PLANTS I KNOW

There are many plants in your playground and your home garden. Make a list of the names of as many as you can. If it is a native plant put N after it. If you can find seeds on it put S. Example, Cootamundra Wattle N.S.

If you are very interested in trees and shrubs and want to help take care of them you should become a Tree Warden.

If you are very interested in birds why not become a member of the Gould League of Bird Lovers. Your teacher will tell you how to join either of these groups which help to look after our beautiful plants and birds.

Never harm or destroy any living thing unnecessarily.

OUR LOCAL BIRDS

You should write about at least one bird each term. You may not be able to find answers to all the questions but do your best.

Remember the school area is a Bird Sanctuary. Are you a member of the Gould League? Never harm a bird or its eggs.

1. Name of Bird .... Where seen ....
   Seen Alone, Small Number or Flock ....
   Call .... Kind of Beak .... Kind of Feet ....
   Food ....
   NEST: When built .... Where built ....
   What made of ....
   EGGS: Number .... Colour ....
   When young birds hatched ....
   Anything else ....

---

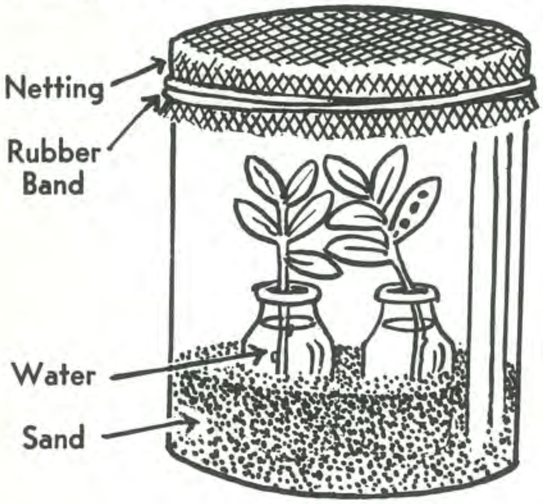
2. Name of Bird .... Where Seen ....
   Seen Alone, Small Number or Flock ....
   Call .... Kind of Beak .... Kind of Feet ....
   Food ....
   NEST: When built .... Where built ....
   What made of ....
   EGGS: Number .... Colour ....
   When young birds hatched ....
   Anything else ....

---

3. Name of Bird .... Where seen ....
   Seen Alone, Small Number or Flock ....
   Call .... Kind of Beak .... Kind of Feet ....
   Food ....
   NEST: When built .... Where built ....
   What made of ....
   EGGS: Number .... Colour ....
   When young birds hatched ....
   Anything else ....

THE LIFE STORY OF AN INSECT

To study the life story of an insect make yourself an "Insectarium". You need a large glass jar, some mosquito netting, some sand, two ink bottles and a large rubber band. The drawing shows you how to make your "Insectarium".



Find a leaf or twig with some insect eggs on it. Place it in one of the small bottles of water. If the top of the bottle is large you may have to put netting over it so that the caterpillars do not fall in and drown. While the caterpillars are growing change the leaves regularly.

Always give them the same kind of leaves. Keep records of the life history of some insects. Do not keep too many caterpillars in the jar at once.

Name of insect.................................... [You may have to fill this in at the end]

When eggs found.................................... Kind of plant....................................

When eggs hatched..

Description of caterpillar..

When pupa formed..

Description of pupa..

When adult insect came out..

Description of insect..

Name of insect..

When eggs found.................................... Kind of plant....................................

When eggs hatched.................................... Description of caterpillar....................................

.... When pupa formed....................................

Description of pupa..

When adult insect came out..

Description of insect..

DRAWINGS OR PICTURES OF BIRDS AND INSECTS

WHAT I FOUND OUT ABOUT LOCAL ANIMALS

WHAT I FOUND OUT ABOUT LOCAL ANIMALS

PICTURES OF LOCAL ANIMALS

PICTURES OF LOCAL ANIMALS